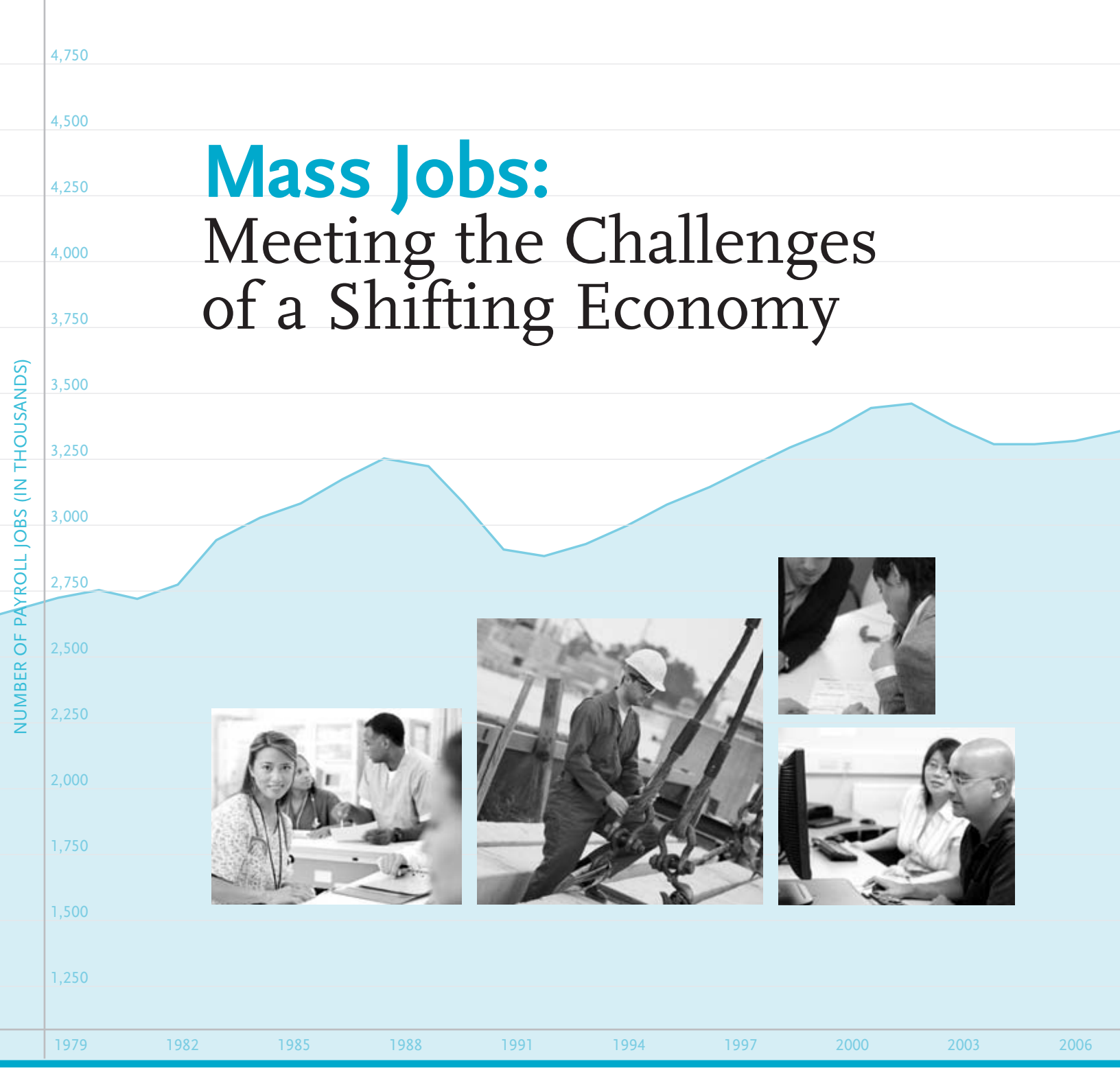
Mass Jobs:
Meeting the Challenges of a Shifting Economy



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MassINC wishes to express its thanks to those individuals and organizations whose financial support makes our work possible. Your generosity is deeply appreciated.

MassINC's Mission

The mission of MassINC is to develop a public agenda for Massachusetts that promotes the growth and vitality of the middle class. We envision a growing, dynamic middle class as the cornerstone of a new commonwealth in which every citizen can live the American Dream. Our governing philosophy is rooted in the ideals embodied by the American Dream: equality of opportunity, personal responsibility, and a strong commonwealth.

MassINC is a non-partisan, evidence-based organization. We reject rigid ideologies that are out of touch with the times and we deplore the too-common practice of partisanship for its own sake. We follow the facts wherever they lead us. The complex challenges of a new century require a new approach that transcends the traditional political boundaries.

MassINC is a different kind of organization, combining the intellectual rigor of a think tank with the vigorous civic activism of an advocacy campaign. Our work is organized within four Initiatives that use research, journalism, and public education to address the most important forces shaping the lives of middle-class citizens:

- **Economic Prosperity** — Expanding economic growth and opportunity
- **Lifelong Learning** — Building a ladder of opportunity through the continuum of learning
- **Safe Neighborhoods** — Creating crime-free communities for all
- **Civic Renewal** — Restoring a sense of "commonwealth"

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About MassINC's Economic Prosperity Initiative

Through the Economic Prosperity Initiative, MassINC works to improve the overall economic well-being of Massachusetts citizens by pursuing answers to a range of economic questions. Among them: How hard are people working and for what kinds of rewards? How secure are their futures? How healthy are our families? What are the strengths and limitations of state government in promoting economic activity? What is the role of the private sector? And, what are the keys to our future economic success?

MassINC has a long history of work within this initiative. Past research projects include: *Reconnecting Massachusetts Gateway Cities: Lessons Learned and an Agenda for Renewal* (2007); *Mass Economy: The Labor Supply and Our Economic Future* (2006); *The Changing Face of Massachusetts* (2005), *The Graying of Massachusetts* (2004), *Mass.Commuting* (2004), *Mass.Migration* (2003), *The State of the American Dream in Massachusetts, 2002* (2002), *The Road Ahead: Emerging Threats to Workers, Families, and the Massachusetts Economy* (1998), and *Lessons Learned: 25 Years of State Economic Policy* (1998).

All of MassINC's research and *CommonWealth* articles are available free-of-charge through our website, www.massinc.org.

Mass Jobs:
Meeting the Challenges of a Shifting Economy

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Harvard Pilgrim Health Care

Merrimack Valley Economic Development Council, Inc.

November 2007

Dear Friend:

MassINC is proud to present *Mass Jobs: Meeting the Challenges of a Shifting Economy*. This joint project with the Center for Labor Market Studies at Northeastern University was made possible by the generous support of The Bank of New York Mellon Charitable Giving Program/Alice P. Chase Trust, The Boston Foundation, EMD Serono, Inc., Harvard Pilgrim Health Care, and Merrimack Valley Economic Development Council, Inc.

The Massachusetts economy is the envy of many other states. Our economy consistently ranks among the top in measures of New Economy success. We rank near the top of the nation in our level of labor productivity and have outpaced the nation in recent years in the rate of growth. We have the most educated workforce in the nation. We also score near the top in terms of knowledge jobs and innovation capacity.

Yet, Massachusetts faces a number of challenges. We are still down about 100,000 jobs from the peak of the business cycle in 2001 and are one of only seven states that has not recovered all of the jobs it had at that point. Given that Massachusetts is an older state that is already highly developed, it makes sense that Massachusetts is not a leader in job creation. Nonetheless, the fact that we are trailing our economic competitor states in job creation as well as trailing the other New England states is worthy of discussion and debate. The loss of jobs in our state has had a number of negative consequences. The job losses have contributed to large numbers of residents moving out of our state, seeking better opportunities elsewhere.

In recent years, the Massachusetts economy continues to shift toward knowledge-based industries, and the economy that is emerging might be described as a "boutique economy." The Massachusetts economy is becoming highly specialized with great rewards for those with the requisite levels of education and skills and fewer options for everyone else. This trend is occurring nationally as the U.S. economy is reshaped by the global economy, but Massachusetts is at the leading edge in this transition. The long-term consequences of a boutique economy, especially for middle-class families, are not yet fully known. We hope this research sparks a renewed urgency to make certain that all residents have the education and skills to benefit from the new job opportunities.

We are extraordinarily grateful to our partners: Andrew Sum and his colleagues at Northeastern University. In this project, as in all of their work, they have gone well beyond the call of duty, and in doing so, they have broadened and deepened our understanding of the Massachusetts economy and of the critical challenges ahead. On the MassINC team, Dana Ansel, our talented research director, has led this important—and complicated—project. We would also like to thank the many reviewers whose critical insights have strengthened this report.

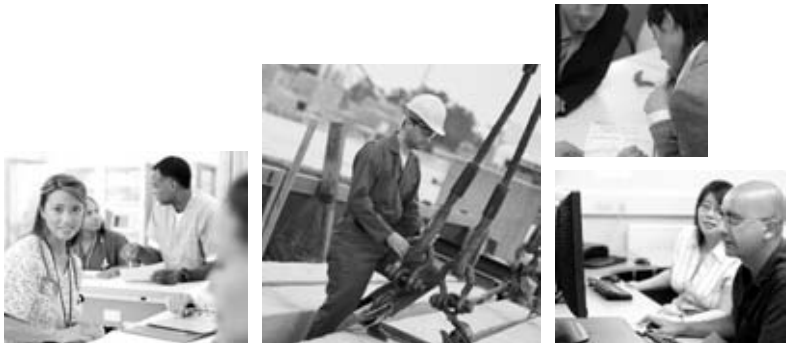
Finally, we would like to thank all of our sponsors who have been generous and enthusiastic partners throughout this project. They have been ideal sponsors, encouraging the authors to go where the data led them. MassINC aims to inject solid, objective research into public policy debates, and to that end, we hope that you find *Mass Jobs* a provocative and timely resource. We invite you to become more involved in MassINC, and we welcome your feedback.

Sincerely,

Greg Torres
President

Gloria Cordes Larson
Co-Chair

Peter Meade
Co-Chair



Mass Jobs:
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EXECUTIVE SUMMARY

There are signs of recovery in the Massachusetts economy. The state has been steadily adding jobs since early 2004. Per-capita income has grown over the past three years. Massachusetts ranks in the top tier of states in the nation in its level of labor productivity. And, the number of people leaving our state has declined in recent years.

Yet, a closer look reveals a shifting economy, with Massachusetts facing a number of challenges to achieving a full economic recovery. Massachusetts suffered steeper job losses than the nation during the recession and has added fewer jobs during the recovery.[1] In fact, Massachusetts is still down roughly 100,000 payroll jobs from the peak of 2001 and is one of only seven states that has still not recovered all of the payroll jobs that it had at the peak of the business cycle.[2] In this research, we analyze the state's recent record of job creation. Jobs are the cornerstone of a strong economy, creating opportunities for individuals, as well as generating tax revenue for the state. The story of job loss and job creation is important to understanding the shifting Massachusetts economy and has important implications for workers, families, and the Commonwealth.

While the state is lagging in overall job creation, the Massachusetts economy consistently ranks among the top states in measures of New Economy success, such as productivity levels. This research documents how the state's economy continues to move even further toward a knowledge-based economy. Talk about the "new economy" can seem like old news, but recent data show that the transition to a knowledge-based economy is far from completed. In the last six years alone, the state has shed, on net, more than 100,000 manufacturing jobs, and these recent losses come on the heels of large job losses in previous decades. Meanwhile, jobs in some service sectors and knowledge-based industries have been increasing, and existing job vacancies suggest a labor market still in transition.

Indeed, the economy that is emerging might be described as a "boutique economy." The Massachusetts economy is becoming highly specialized with great rewards for those with the requisite levels of education and skills and fewer options for everyone else. This trend, which is occurring nationally as the U.S. economy continues to be reshaped by the global economy, appears to be happening at an accelerated pace in Massachusetts. The long-term consequences of a boutique economy are not yet fully known. What will happen to middle class families, the foundation of a healthy commonwealth? This research study analyzes how, in contrast to earlier decades, the recent gains in productivity have not been broadly shared by workers. Moreover, as our previous research, *Mass Economy: the Labor Supply and Our Economic Future* documented, significant numbers of men in their prime working years have withdrawn from the labor force, meaning that they are neither working nor looking for work. The largest drop in participation has been for high school graduates and high school dropouts, and the challenges are most acute in the state's large urban centers. As the bar for success has been raised, a shared urgency is needed to make certain that all residents of the Commonwealth have the education and skill levels needed to benefit from the new job opportunities of the

THE EMERGING ECONOMY MIGHT BE DESCRIBED AS A "BOUTIQUE ECONOMY."

Massachusetts economy. Otherwise, they will suffer from even greater economic penalties as the economy continues to shift and the routes to economic success narrow.

Within the state's economy, there are marked differences across business sectors. A state's competitive position can be measured by analyzing the share of the nation's jobs that it holds in all industries and in a given industry over a period of time. Simply put, are we gaining or losing national share? Rising shares indicate the strengthening of a state's competitive position, while declining shares indicate deterioration. This research study reveals that Massachusetts has lost some of its competitive position in several key industries, not only in manufacturing but also in some knowledge-based sectors. Since 2000 the share of the nation's finance jobs located in Massachusetts has declined, as has the share of professional and business service jobs and high-tech jobs. The loss of market share in some of the state's key industries highlights the fact that while higher skills are necessary for success in today's economy, they do not guarantee protection from an increasingly competitive and volatile national and global economy.

The fate of the state's high-tech sector is perhaps the most telling. Due to industry downsizing and restructuring, job losses in high-tech swept across the nation during the recession of 2001 and in following years.[3] But the Massachusetts high-tech sector was hurt even more than elsewhere. Going into the recession, our economy was more dependent on high-tech industries than the rest of the nation, and the high-tech job losses that followed in Massachusetts were steeper than elsewhere. As a consequence, the share of the nation's high-tech jobs located in Massachusetts declined. In 2000, 4.2 percent of the nation's high-tech jobs were located in Massachusetts. By

KEY FINDINGS:

- From the onset of the national recession in the first quarter of 2001 through the first quarter of 2004, Massachusetts lost, on net, nearly 200,000 payroll jobs. Massachusetts' rate of job loss over this period was the highest in the nation. Although Massachusetts accounted for only 2.5% of the payroll jobs in the country in 2001, the state absorbed 7.3% of the net job losses of the recession.

- Since early 2004, the state has slowly added jobs, but as of June 2007 the state is still down 100,000 jobs, or 3 percent, from the peak of the cycle in 2001. From 2001 QI to 2006 QIV, Massachusetts ranked 49th in the nation in job creation, outpacing only the state of Michigan.

- Compared with our 10 economic competitor states, Massachusetts ranked last in job creation in recent years and was the only one of those states that had not recovered all of its 2001 jobs.

- The share of the nation's payroll jobs located in Massachusetts declined from 2.98% in 1988 to 2.38% in 2006. If Massachusetts had been able to maintain its 1988 share of national payroll jobs, the state would have had an additional 815,000 jobs in 2006.

- The Greater Boston area has not yet recovered all the jobs lost during the downturn. In the first half of 2006, the counties of the Greater Boston region were still down 4 to 7 percent from the early 2001 peak.

- Massachusetts' large cities and high-tech centers have suffered the greatest job losses. Four communities (Burlington, Waltham, Attleboro, and North Andover) experienced job losses greater than 10%. Unemployment rates in the big cities have risen sharply.

- Between 2000 and 2005, Massachusetts lost 58,000 high-tech jobs. Employment in the high-tech sector in Massachusetts shrank by 23%. The share of the nation's high-tech jobs located in Massachusetts declined from 4.2% to 3.9%.

2005, the state held only 3.9 percent of the nation's high-tech jobs. The significant contraction of our high-tech industries is a key factor in explaining why our state suffered overall greater job losses than elsewhere.

In contrast, the biotech sector has been growing and is one of the few sectors where the state has enhanced its competitive edge, increasing the share of the nation's jobs located in our state.[4] This is especially important for the state's economy because many biotech jobs are export-oriented jobs, meaning that these companies produce goods and services at levels over and beyond the demand for them within our state. These goods and services are sold in other states or countries, bringing new revenue into our state and benefiting other sectors throughout our economy through a positive multiplier effect. Thus, there is sound economic support for investment in the biotech sector. It is, however, important not to lose perspective on the size of the sector as a share of the state's overall job base. The biotech sector consists of roughly 75,000 jobs in Massachusetts, accounting for only 2.4 percent of the state's payroll jobs. In contrast, manufacturing, despite large job losses, still accounts for about 9 percent of the state's jobs. While biotech has grown considerably, the sector represents only a small part of the state's economy and its export base.

There is no doubt that Massachusetts has been successful in its ability to embrace and prosper from the transition to a knowledge-based economy. Yet, simultaneously, Massachusetts is struggling to fully recover from the recession of 2001, relative to its economic competitor states as well as the nation as a whole. From the first quarter of 2001 through the end of 2006, Massachusetts ranked 49th among the 50 states in job creation, outpacing only Michigan. Given that Massachusetts is an older state that is already

- Between 2000 and 2005, the state has been adding jobs in the biotech sector at more than double the national rate (15% vs. 7%). Between 2000 and 2005, the state added nearly 10,000 new biotech jobs. During these five years, the share of the nation's biotech jobs located in our state increased from 4.5% to 4.9%.

- The Massachusetts economy continues to shift toward knowledge industries. Between 2000 and 2006, the state lost 104,000 manufacturing jobs, and the number of manufacturing jobs shrank from 13% to 9% of the state's payroll jobs. At the same time, the state's economy has become even more dependent on health care. Health care accounts for 12% of the state's jobs, and the largest number of job vacancies are in fields related to health care services.

- Real output of goods and services in Massachusetts has steadily increased since 2002. The gains are entirely a result of increases in labor productivity (real output per worker). Our level of productivity is one of the highest in the nation's and has grown faster than the nation's in recent years. From 2001 to 2005, the level of real output per worker grew by 11.5% in Massachusetts, compared with a national increase of 10.6%.

- The job losses in our state have contributed significantly to high levels of domestic outmigration. Between 2000 and 2006, 286,000 Massachusetts residents, on net, moved to another state, which is equivalent to 4.6% of the state's 2000 population. Relative to the size of our state's population, this level of outmigration was the 3rd highest in the nation, trailing only New York and Louisiana.

highly developed with slow population and labor force growth, it follows that Massachusetts would not be a state leader in job creation. But, the fact is that Massachusetts lags behind our economic competitor states and all other states in the New England region in its ability to recover and create jobs in the national recovery. The loss of payroll jobs has had a number of negative consequences. Steep job losses have contributed to a large number of residents moving out of our state, choosing to seek better opportunities elsewhere. Opportunities for social mobility for middle-class families have become more limited without the right set of skills and education. Over time, without jobs and without workers, Massachusetts becomes a less attractive place to be for families and businesses.

Creating and Losing Jobs: The Historical Record

In most of the post-World War II era, Massachusetts created relatively fewer jobs than the nation as a whole. The exception was the decade of the 1980s. During that decade, Massachusetts came quite close to matching the nation's growth rate in payroll employment of 20 percent. In just one year, 1984, Massachusetts created, on net, 159,000 new payroll jobs. It was at this time that state political leaders began to refer to the "Massachusetts Miracle."

The 1980s job boom ended abruptly in early 1989 as the state entered a steep recession that would last through 1992. During these four years, the state lost an extraordinary 320,000 payroll jobs, or 10 percent of the state's job base. Beginning in 1992, the state began to add jobs. Between 1992 and 2000, the state added 531,000 net new payroll jobs—making up the 320,000 lost jobs and adding 211,000 net new jobs. Many of the new jobs were in different industries and occupations than those that had been lost, shifting the Massachusetts economy more toward a service and knowledge-based economy. While the rate of job creation during the 1990s was among the lowest in the nation, the state nonetheless enjoyed a major economic expansion over the decade from 1992 onward. From 1989 to 1999, real output per worker increased by 24 percent in Massachusetts, outpacing the nation's productivity growth by 10 percentage points. Massachusetts ranked 5th highest in the nation in its level of labor productivity (real output per worker). The state's economic prosperity during the 1990s was heavily influenced by this boom in productivity.

The economic expansion of the 1990s came to an abrupt end in early 2001, as the national recession began. When the Massachusetts labor market bottomed out in early 2004, the state was down nearly 200,000 payroll jobs from the previous peak in early 2001. Massachusetts experienced the highest relative loss of payroll jobs among the 50 states between the first quarters of 2001 to 2004. The state steadily added payroll jobs from 2004 through June 2007, which was the most recent employment data available at the time of this research. Even with these recent job gains, however, the state was still down approximately 100,000 payroll jobs, or 3 percent from the peak of the business cycle.[5] While the New England region had not regained all of the jobs it had at the peak of early 2001, four of the six New England States—Maine, New Hampshire, Vermont, and Rhode Island—experienced modest job growth between 2001 and 2006. Connecticut experienced modest job loss (-0.2%), and Massachusetts trailed far behind (-3.8%). The job losses in Massachusetts and Connecticut outweighed the gains in the smaller states. In sharp contrast, the nation regained all the jobs lost and then added 5 million net new payroll jobs during this time period. Massachusetts is one of only 7

states in the nation that has not yet recovered all the jobs that it lost during the recession.

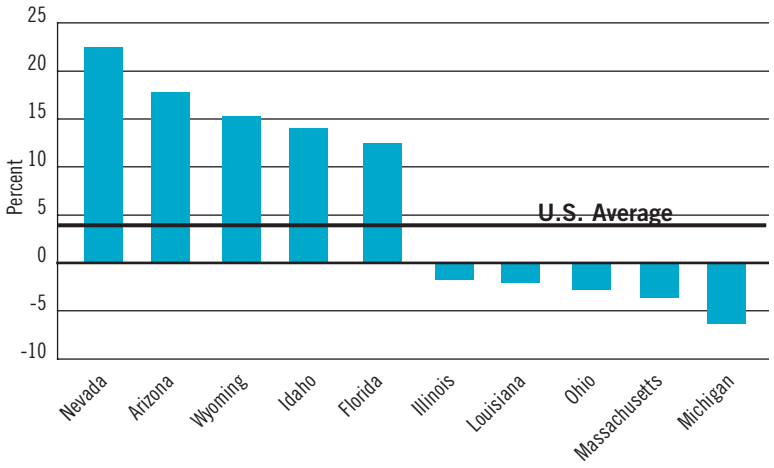
The state's lackluster record of job creation during the past six years is the consequence of both greater job losses during the recession of 2001 and the jobless recovery of 2002 and 2003, and relatively fewer job gains in the recovery period. Our state suffered a disproportionate share of payroll job losses during the national recession. Although Massachusetts accounted for only 2.5 percent of all jobs in the country, the state absorbed 7.3 percent of the net job losses during 2001-2003 period. As the nation has recovered from the recession, job creation in Massachusetts has continued to lag behind the country even with recent job gains. In the first six months of 2007, Massachusetts added 34,200 jobs, which was a 1.1 percent increase over the total number of payroll jobs in the first six months of 2006. During this same time period, the nation created jobs at a rate of 1.5 percent. Even with the improved job gains in recent months, Massachusetts is still trailing the nation.

Perhaps more telling is the comparison of Massachusetts' performance with its economic competitor states. The ten economic competitor states are: California, Colorado, Connecticut, Florida, Minnesota, New Jersey, New York, North Carolina, Texas, and Virginia.[6] From the first quarter of 2001 through the first half of 2007, the nation's payroll jobs grew by 3.6 percent. The combined rate of job growth in Massachusetts and its 10 competitor states outpaced that of the nation, increasing by 4.3 percent. Florida led in job creation, growing by a remarkable 13.3 percent. Texas grew by 7.1 percent, and Virginia grew by nearly 7 percent. In sharp contrast, the number of jobs in Massachusetts shrank by 3 percent during this time period. Compared with our competitor states, Massachusetts was at the bottom in terms of job creation. Among these states, only Massachusetts and New York had not yet recovered all of their 2001 payroll jobs.

Since the 1980s, Massachusetts has gone through periods of substantial job creation as

ES Chart 1:

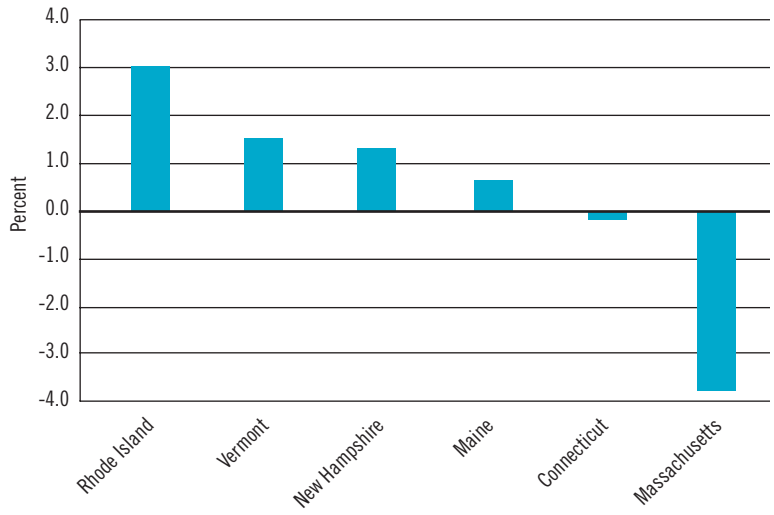
Growth Rates of Payroll Employment in the Top Five and Bottom Five Ranked States, 2001 QI – 2006 QIV



Source: Current Employment Statistics (CES), US Bureau of Labor Statistics
Note: Nonfarm Employment

ES Chart 2:

Growth Rates of Payroll Employment in New England, 2001 QI – 2006 QIV



Source: Current Employment Statistics (CES), US Bureau of Labor Statistics
Note: Nonfarm Employment

ES Table 1:

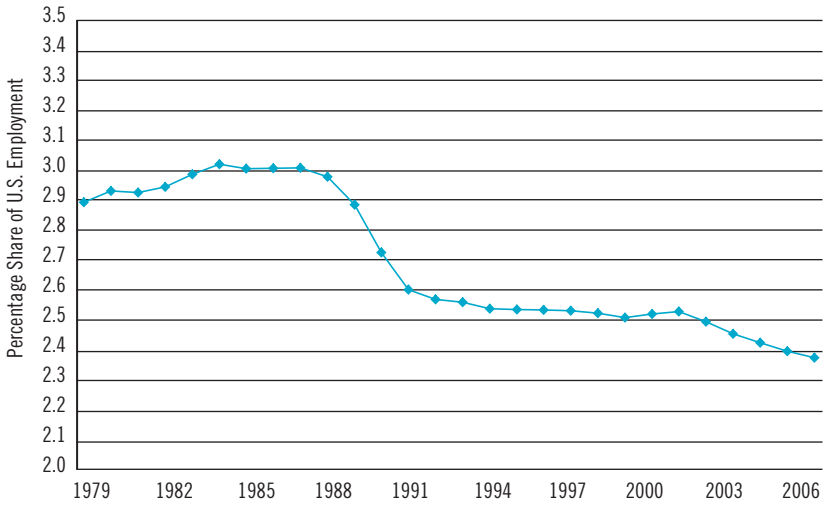
Total Employment in Massachusetts and Its Economic Competitor States from the First Quarter 2001 to First Half 2007 (Numbers in 1000's)

STATE	FIRST QUARTER 2001	FIRST HALF 2007	PERCENT CHANGE	RANK BY % CHANGE
Florida	7155.7	8108.2	13.31%	1
Texas	9550.6	10228.8	7.10%	2
Virginia	3531.7	3766.9	6.66%	3
North Carolina	3939.0	4090.9	3.86%	4
California	14722.8	15241.1	3.52%	5
Colorado	2248.3	2313.5	2.90%	6
Minnesota	2708.3	2782.7	2.75%	7
New Jersey	3996.8	4090.1	2.34%	8
Connecticut	1686.5	1694.6	0.48%	9
New York	8683.4	8676.7	-0.08%	10
Massachusetts	**3380.6**	**3270.7**	**-3.25%**	**11**
US Total	132508.7	137665.3	3.89%	

Source: Current Employment Statistics (CES), U.S. Bureau of Labor Statistics, CLMS Tabulations
Note: Nonfarm Employment

ES Chart 3:

Share of the Nation's Jobs Located in Massachusetts



Source: Current Employment Statistics (CES), U.S. Bureau of Labor Statistics, CLMS Tabulations.

well as periods of significant job loss. Overall, from 1988 to 2006, the state has only added 105,000 payroll jobs, growing by 3.6 percent. Meanwhile the nation has increased its payroll employment eight times as fast as Massachusetts (29.3%). As a consequence, Massachusetts has steadily lost share in terms of the relative number of the nation's jobs that are located in our state. In 1988, Massachusetts was home to 2.98 percent of the nation's jobs. By 2006, the state was home to only 2.38 percent of the nation's jobs, which represented a new historic low. If Massachusetts had been able to maintain its 1988 share of national payroll jobs (2.98%), the state would have had an additional 815,000 jobs in 2006. Moreover, as we shall see, Massachusetts appears to be losing its competitive edge in several of the state's key industries.

The Geography of Jobs

The economic fortunes of regions within the state have varied considerably over the last few decades. Job loss during the 1989-1992 recession was spread fairly evenly across the state. As the state recovered from that recession, however, the pace of job creation varied widely across the regions. The Cape and Islands and Greater Boston were among the fastest growing areas of the state. In contrast, the economic expansion of the 1990s largely bypassed Western Massachusetts, and the economic divide between the different regions of the state increased markedly.[7]

In recent years, there also has been wide variation in job creation and jobs loss in labor markets across the state. Overall, from early 2001 to the fourth quarter of 2006, the state lost 3.8 percent of its payroll jobs. Yet, despite an overall loss of jobs statewide, six of the state's fourteen counties added jobs during this period. The small island country of Nantucket actually increased its jobs by 14.6 percent. Payroll jobs in Plymouth, Barnstable, and Dukes counties also grew. In the western part of the state, Hampshire and Berkshire grew slightly, as well. In sharp contrast, in

the first half of 2006, job levels in Middlesex, Suffolk, and Essex counties, which comprise the Greater Boston region, were still down by 4 to 7 percent from their peak levels in early 2001. In recent years, Greater Boston has added jobs but not enough to recover all the jobs lost from 2001 to early 2004.

The state's large cities and high-tech centers have absorbed a disproportionate share of job losses. North Andover —primarily because of the closing of Lucent Technologies—has suffered the greatest relative decline in employment, losing 27 percent of its payroll jobs. Attleboro, Waltham, and Burlington also suffered double-digit losses. In absolute terms, both Cambridge and Waltham lost roughly 10,000 jobs. As of 2006, the city of Boston was still down approximately 41,000 jobs (7.1%). Unemployment rates in the big cities have risen sharply, and teens and young adults, especially those with limited education, have suffered the consequences. Although most of the large cities have added jobs since 2004, the recovery of the state's cities still lags behind the rest of the state.

ES Table 2:

Unemployment Rates in Selected Cities of Massachusetts, 2005 (in percent)

	UNEMPLOYMENT RATE
Springfield	12.8
New Bedford	10.7
Boston	9.1
Fall River	8.7
Worcester	8.3
Brockton	7.8
Lynn	6.7
Lowell	5.3
Cambridge	4.7

Source: American Community Survey, 2005, U.S. Census Bureau, tabulations based on findings on the Census Bureau website.

Massachusetts' Competitive Advantages: Winning and Losing

The overall rates and levels of job creation provide only a partial picture of the health of a state's economy. As telling is what is happening within individual industrial sectors. A state's competitive position can be measured by analyzing its share of national jobs in a given industry over a period of time and relative to economic competitor states. Rising shares indicate the strengthening of a state's competitive position, while declining shares indicate deterioration.

THE STATE'S LARGE CITIES ABSORBED A DISPROPORTIONATE SHARE OF JOB LOSSES.

If an industry is growing nationally, we can ask: "Is that industry in our state growing at the same rate?" If the answer is yes, then our state would maintain its share of jobs in that industry, holding onto its competitive position. If jobs in that industry are growing faster in our state than elsewhere, we would gain share in that industry. Conversely, if jobs in our state are not growing at the national rate, we would lose industry share. Job loss can be understood the same way. If our state loses jobs in a given industry at the same rate as the nation, perhaps as a result of industry restructuring, our share will remain the same. However, if our job losses occur at a steeper rate than the national average, our share of jobs in an industry will decrease, indicating a decline in our competitive position. With this information in mind, let's consider what has happened in recent years in two of the state's key sectors: high-technology and biotechnology.

The Competitive Position of High-Technology Industries

After experiencing large job losses in the early to mid-1970s, Massachusetts emerged as a leader in the nation's new high-technology sector, and the industry helped to drive future economic booms.[8] Although the high-tech industry in Massachusetts grew by an impressive 17.3 percent in the 1990s, we actually trailed the industry's national job growth rate of 36 percent. Thus, the share of the nation's high-tech jobs located in Massachusetts declined from 4.8 to 4.2 percent between 1990 and 2000. Even so, our state was more dependent on high-technology industries for our jobs than the nation, with the industry accounting for a much larger share of the jobs in the Massachusetts economy compared with the nation's economy. In 2000, high-technology industries accounted for nearly 9 percent of the state's jobs, while they represented only 5 percent of all payroll jobs in the national economy. In 2000, our economy still was heavily dependent on the high-tech sector.

OUR STATE WAS MORE DEPENDENT ON HIGH-TECHNOLOGY INDUSTRIES.

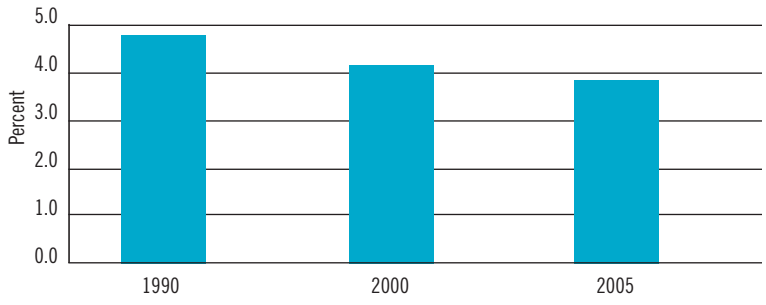
As the recession of 2001 set in, job losses in the high-tech sector swept across the nation due to industry downsizing, restructuring, offshoring, and other factors. But, with respect to the Massachusetts economy, there are two noteworthy facts: 1) Going into the recession, our economy was more dependent on the high-tech industry than the rest of the nation; and 2) the high-tech job losses in Massachusetts were steeper than they were elsewhere. Between 2000 and 2005, Massachusetts lost roughly 58,000 high-tech jobs, or 22.8 percent of all the state's high-tech jobs. The nation shed more than 1 million high-tech jobs, but the relative decline in Massachusetts was even steeper. Nationally, payroll employment in the sector declined by 17 percent, but in Massachusetts, it shrank by 23 percent. By 2005, the state had fewer high-tech jobs than it had had in 1990.

As a result of our steeper job losses, the share of the nation's high-tech jobs located in Massachusetts declined. In 1990, 4.8 percent of all the nation's high-tech jobs were located in Massachusetts. By 2000, that share had declined to 4.2 percent, and by 2005, only 3.9 percent of the nation's high-tech jobs were in Massachusetts. This steep decline in the state's share of national high-technology jobs indicates that our state has lost some of its competitive position in the high-tech sector. The recent fate of the high-tech industry and our state's above-average dependence on the industry for its jobs is a key reason why our state economy has suffered greater job losses than the nation over the 2001-2003 period.

Massachusetts, however, was not alone among its competitor states in losing both high-tech jobs and its share of the high-tech sector. Six of our 10 competitor states also lost national share in the high-technology sector during this

ES Chart 4:

Share of the Nation's High-Tech Jobs in Massachusetts



Source: Quarterly Census of Employment and Earnings (QCEW), U.S. Bureau of Labor Statistics, tabulations by authors..

period. The share of the nation's high-technology jobs in California declined from 17.0 percent to 16.0 percent. Texas, New York, Colorado, New Jersey, and Connecticut also lost some of their competitive position in this sector. In contrast, Florida, Virginia, and Minnesota were able to enhance their competitive position, and North Carolina's share of high-tech jobs held steady over the past six years. The fact that some of the traditional high-tech states have also lost share suggests that other states in the country have become successful at creating or luring high-tech jobs to their states.

The Competitive Position of the Biotech Industry

In recent years, increased attention has been focused on the biotech industry by political leaders and legislators in a growing number of states.[9] States across the country have been competing to attract biotechnology industries through tax incentives, grants, and other incentives. In May 2007, Governor Patrick announced a 10-year, $1 billion life-sciences initiative in Massachusetts in order to make Massachusetts "the global leader" in the industry.

Jobs in biotechnology industries have been increasing since the early 1990s in both Massachusetts and the United States. In Massachusetts, the number of jobs in biotech has increased from 53,444 in 1990 to 65,043 in 2000 and to 75,074 in 2005. In the 1990s, biotech employment grew at a faster rate in our state than it did in the nation (22% vs. 14%). As a consequence, the state improved its competitive position in the industry during the 1990s, increasing its share of the nation's biotech jobs from 4.2 percent in 1990 to 4.5 percent in 2000. Thus, during the 1990s, the state strengthened its competitive position in the biotech industry.

Between 2000 and 2005, the state continued to add jobs in the biotech industries, despite job losses in other sectors. Between 2000 and 2005, the state added nearly 10,000 new biotech jobs.[10] Once again, the state outpaced the nation in job growth in the biotech industry, adding jobs at more than double the national rate (15% vs. 7%). Because of this above-average growth, the state continued to gain share within the biotech industry. In 2005, Massachusetts was home to 4.9 percent of the nation's biotech jobs.

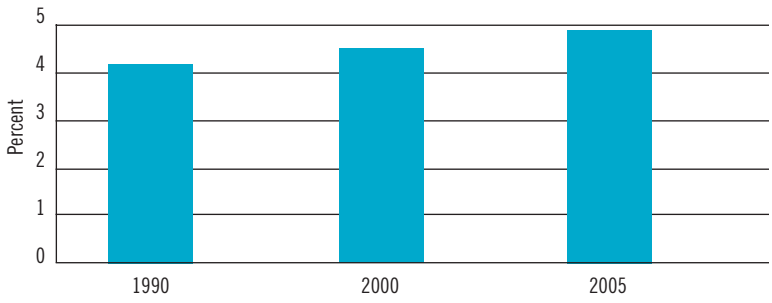
MASSACHUSETTS OUTPACED THE NATION IN JOB GROWTH IN THE BIOTECH INDUSTRY.

Compared with our competitor states, Massachusetts is in a strong position in the biotech industry. Virginia and North Carolina also gained job share in the industry between 2000 and 2006, but other states, such as New Jersey, California, New York, and Connecticut, lost share.

Biotech has been one of the few sectors where the state increased its competitive edge in recent years. This is especially important because we estimate that at least half of the jobs in the biotech industry are export-oriented, meaning that Massachusetts produces goods and services

ES Chart 5:

Share of Nation's Biotech Jobs Located in Massachusetts



Source: Quarterly Census of Employment and Earnings (QCEW), U.S. Bureau of Labor Statistics. CLMS Tabulations.

for sale to other states or countries. Export-oriented jobs bring revenue into our state, creating a positive multiplier effect that generates jobs in other industries of the economy. Thus, there is sound economic reason for the excitement around future investment in the biotech industry. But the sector is relatively small. Biotech consists of roughly 75,000 payroll jobs in Massachusetts and accounts for only 2.4 percent of the state's jobs. While it has grown considerably, the biotech sector is still only a small part of the Massachusetts economy.

A Boutique Economy: The Shifting Structure of the Massachusetts Economy

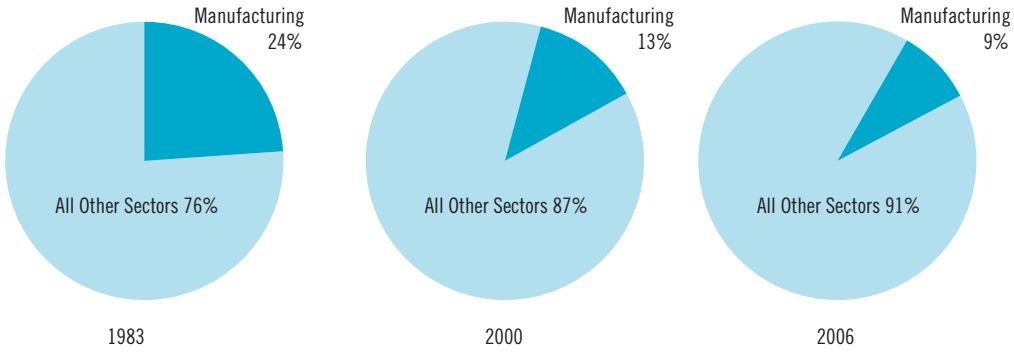
Over the last 25 years, the Massachusetts economy has undergone a number of dramatic structural changes.[11] As the economy continues to shift from a goods-producing economy to a services-providing economy, the types of jobs and economic opportunities available to workers have been fundamentally altered. The demand for workers with college degrees has grown, while there have been large declines in traditional blue-collar jobs, largely because of a rapidly shrinking manufacturing sector. Many of these manufacturing jobs were key elements of the state's export base, producing goods for sale outside of our state. Thus, their loss has generated negative multiplier effects on the rest of the state's economy. The job losses and gains of recent years have further shifted the Massachusetts economy toward a service and knowledge-based economy, with narrowed opportunities for economic success.

In 1983, there were 629,000 manufacturing jobs in Massachusetts, and nearly one-quarter (24%) of all jobs in Massachusetts were manufacturing jobs. By 2000, however, there were just 403,000 manufacturing jobs in the Bay State, and the industry represented only 13 percent of the state's payroll jobs. From 2000 to 2006, the state lost another 104,000 manufacturing jobs. In six short years, the sector shrank to only 9 percent of the state's payroll jobs.

During this time, manufacturing jobs were also disappearing across the country, but the relative size of these job losses was far steeper in Massachusetts. Nationally, between 2000 and 2006, the country shed 18 percent of its manufacturing jobs, while Massachusetts lost 26 percent of its manufacturing jobs. As a result, the share of the nation's manufacturing jobs located in our state declined from 2.3 to 2.1 percent. While most of our competitor states also lost share in manufacturing, several states—Texas, Florida, and Minnesota—were able to increase

ES Chart 6:

Manufacturing Jobs as a Share of Massachusetts Employment



Source: (i). Annual Population Estimates, U.S. Census Bureau, Population Division. CLMS Tabulations.
(ii). Current Employment Statistics (CES), U.S. Bureau of Labor Statistics, CLMS Tabulations.

their share of the nation's manufacturing jobs in recent years. As manufacturing jobs have disappeared, the routes to economic success for workers without a college degree have continued to narrow, especially for men who have limited formal education and have traditionally worked in blue-collar manufacturing jobs. One consequence has been a steady decline in the annual earnings of men in Massachusetts who do not have a college degree. The loss of these manufacturing jobs has been especially detrimental in the state's Gateway Cities, the traditional mill and manufacturing centers.[12]

There have been other changes in the industrial structure of the state economy. Despite an overall record of net job loss in recent years, there has been job creation within selected industries. Job creation has been heavily concentrated in education, health care, and professional and business services. Of particular note is the health care industry. Between 2001 and 2006, the state added 37,000 new jobs in the health care industries.[13] Over this time period, health care increased from 10.7 percent to 12.1 percent of the state's payroll jobs.[14] Moreover, the largest number of job vacancies in recent years are in health-care-related occupations. In 2006, there were roughly 18,000 vacancies in health care, accounting for nearly 1 in 5 of all job vacancies in the state. Some of the growth in the health care sector is a consequence of an aging population and the growth in Medicaid and Medicare expenditures, not a result of export-based health care and research. A college degree is typically required for entry into many of the industries that are adding jobs.[15] The Massachusetts economy might be described as a boutique economy, with highly specialized jobs of high quality that offer great rewards to those who can participate in it but increasingly limited options for everyone else.

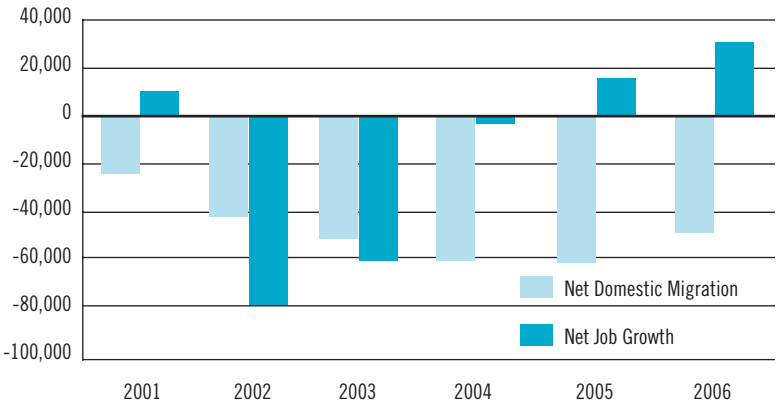
The Consequences of Job Loss: Outmigration

One of the negative consequences of our state's large job losses has been a rising number of people choosing to leave our state to locate elsewhere. While Massachusetts has been a net exporter of people to other states the late 1980s, the number of people leaving our state to locate elsewhere in the nation has risen considerably in recent years. Between 2000 and 2006, 286,000 residents of Massachusetts, on net, chose to move to another state. This extraordinarily high number of outmigrants—equivalent to 4.6 percent of the state's resident 2000 population—distinguishes Massachusetts from other states. Relative to our state's population, this level of outmigration was the 3rd highest in the nation, trailing only New York and Louisiana, which lost population largely as a result of Hurricane Katrina.

The impact of outmigration on our state's economy is substantial. Large numbers of outmigrants are in their prime working-age years, and many of them hold college degrees. Many were also young families with children. Their

ES Chart 7:

Comparisons of Payroll Job Growth[1] and Net Domestic Out-Migration from Massachusetts



Note: Nonfarm employment

departure has limited the state's ability to sustain its population and grow its labor force. It also impacts the pipeline of workers who will be available for jobs in the future.

There has been a lot of focus on the state's high cost of living—specifically high housing costs—as the primary cause of the exodus. While this attention has been warranted, it misses another key factor: the connection between job loss and outmigration. Steep job losses in our state have encouraged residents to seek better opportunities elsewhere, while discouraging people in other states from moving to our state.

In this research study, we quantify the effects of job loss (and high housing costs) on the state's level of domestic outmigration. Between 2000 and 2005, Massachusetts shed, on net, 115,000 payroll jobs, or 3.5 percent of the state's 2000 payroll jobs base. The 3.5 percent loss in jobs, holding everything else constant, led to a 2.1 percentage point increase in outmigration, which is the equivalent of nearly 130,000 people.

Job loss has been equally important as high housing costs in driving Massachusetts residents to seek better opportunities elsewhere. While recent job gains during the last three years have helped modestly reduce the levels of domestic outmigration, the state is still down a large number of jobs from the peak of 2001. Massachusetts ranked 49th in the nation in terms of job creation since 2001, outpacing only Michigan.

Success Through Productivity Growth

One of the key measures of a state's overall economic performance is its Gross State Product (GSP) per capita, which measures the aggregate output of final goods and services of a state's economy as adjusted for the size of the state's population.[16] At the end of the 1980s, Massachusetts per capita real output was 22 percent higher than the national average and ranked 7th highest in the nation. In 2005, the state's GSP per capita was 24 percent higher than the national average, and it ranked 4th highest in the nation.

Real output in Massachusetts has steadily increased since 2002. A variety of factors contribute to the level of output, including the demographic composition of the population, especially the age structure and educational attainment of its working-age population, the labor force participation rate of its working-age residents, the number of hours worked per year by employed residents, and labor productivity (i.e., real output per hour of work or real output per worker). Our state's gains in GSP per capita in recent years are almost entirely a result of increases in labor productivity. Our level of labor productivity, which ranks 7th highest, is one of the highest in the nation and has grown faster than the nation's. From 2001 to 2005, the level of real output per worker grew by 11.5 percent in Massachusetts, compared with a 10.6 percent increase nationally.

Increases in labor productivity, however, do

ES Table 3:

Trends in Labor Productivity (Real Output Per Worker) in Massachusetts and the U.S.

	2001	2005	ABSOLUTE CHANGE	PERCENT CHANGE 2001-2005
Real Output Per Worker in Massachusetts	$84,430	$94,150	$9,720	+11.5
Real Output Per Worker in the U.S.	$75,879	$83,920	$8,041	+10.6

Sources: (i) U.S. Commerce Department, Bureau of Economic Analysis, web site; (ii) Massachusetts Division of Unemployment Assistance, Current Employment Statistics Programs, web site.

not automatically translate into widely shared gains in the earnings of workers. Despite strong productivity gains, workers' wages in Massachusetts, when adjusted for inflation, have basically remained flat during this time period. (Nationally, workers did not fare much better.) Only workers in a few industries saw gains in their real weekly wages, which is markedly different from our state's experience in the 1980s and 1990s, when there was a strong link between growth in productivity and increases in real wages. Workers are more likely to benefit from productivity gains if they work in industries that are growing.

The increases in productivity are partly a result of changes in the types of jobs in the Massachusetts economy and advances in technology, as well as the high education levels and skills of the workforce. Massachusetts has the highest share of its working-age population with a bachelor's or higher degree (32.9%), compared with the national average of only 23.4 percent.

Going forward, however, our state faces a number of challenges in maintaining its edge in labor productivity. Our previous report, *Mass Economy: the Labor Supply and Our Economic Future*, analyzed these challenges in detail and included strategies to address them.[17] As the state's baby boomers age, the ability of existing firms to incorporate more older workers into their internal workforce will be critical to maintaining our labor force. In addition, foreign immigrants will continue to be an important part of the state's future labor force. Yet, as previous MassINC research documents, a relatively high number of new immigrants have limited education and English language skills, which creates a number of challenges for them to fully engage in the Massachusetts economy.[18] Finally, fewer teens and young adults without four-year college degrees are working than in the past. This is troubling for the pipeline of the state's future workforce, in addition to the immediate negative consequences for these individuals and their families. National and state research on this topic strongly indicates that work is "path dependent," meaning the more a person works now, the more likely that person will work in the future. Conversely, if teens and young adults are not working today, they are less likely to work in the future. Creating and implementing innovative workforce strategies to address these challenges are critical for our state's future economic success.

Concluding Thoughts

There is no doubt that our state is the envy of many other states in its ability to embrace and prosper from the knowledge-based economy. According to the Information Technology & Innovation Foundation, a national think tank, Massachusetts ranks first in the New Economy Index.[19] Massachusetts scores at the top in terms of knowledge jobs and innovation capacity. Massachusetts also is a national leader in terms of the level of labor productivity as well as the level of our per-capita income. Despite such positive indicators, the fact that the state lags in job creation has had a negative impact on the state's economy. There have been particular challenges in the state's older industrial cities in their ability to transition to the knowledge-based economy. But, more generally, a lack of jobs constrains revenues for the state, and it also encourages residents to seek better opportunities elsewhere. This research quantifies how our state's lack of jobs has contributed to the high levels of outmigration in

OUR LEVEL OF LABOR PRODUCTIVITY IS ONE OF THE HIGHEST IN THE NATION.

recent years. While the private sector is the engine of job creation, state government can have a significant impact on the business and innovation environment, both positively and negatively. In order to navigate the changing economy, state and local governments have to be nimble and do a better job helping both companies and workers manage the transitions.

To be clear, there are good reasons that Massachusetts lags the nation in net job creation. Our state is an older state with a more developed economy. It is to be expected that states with less mature economies and more rapid population growth will be the engines of rapid growth. In addition, we have made certain policy choices in Massachusetts that inhibit job creation. Most notably, we have policies in place that restrict the supply of housing, which has contributed to our extraordinary high housing costs. Previous research has documented the link between high housing costs and limited job creation, with high housing costs negatively affecting job creation in the Boston metro area.[20] It is not clear what a desirable rate of job growth is for an economy such as ours, but comparisons with our economic competitor states and those in the New England region are telling. From 2000 to 2006, Massachusetts ranked last in terms of job creation, as compared with our 10 economic competitor states. These facts should spur public and private leaders to come together with a greater sense of urgency and purpose to create a broad-based job creation and workforce development strategy. We need a clearer consensus about how a state like Massachusetts can grow jobs and then develop the political and corporate leadership to make it happen.

A LACK OF JOBS ENCOURAGES RESIDENTS TO SEEK BETTER OPPORTUNITIES ELSEWHERE.

The key is to develop a shared economic vision and agenda with specific priorities and outcomes. More research is needed to determine the relative impacts of different policy options on job creation. Policy leaders should sort out the proven factors that matter and create a solid base of knowledge to guide policy choices, rather than relying on anecdotes. Because such a strategy should be more long lasting than any specific Administration, efforts to insulate it from political forces must also be considered, including looking at efforts in other states to promote and coordinate economic development through quasi-public agencies. Finally, a collaborative relationship between the Administration, Legislature, business community, and labor community will be needed to effectively implement it.

We recommend that the following four principles form the foundation of the state's efforts to create 21st century jobs. They are: expanding the number of export-based jobs; creating a job vacancy and workforce strategy, creating a favorable business climate and helping existing Massachusetts companies expand here; and assisting regional economies tow grow by anchoring them to an urban agenda.

Expand the Number of Export-based Jobs

Export-based companies are those businesses that produce goods or services at a level above and beyond the demand from within our own state. These goods and services can then be sold to other states or countries, bringing revenue into our state and creating a positive ripple effect throughout the economy. In addition, export-based jobs are often relatively high paying and thus benefit individual workers and their families. Many economists believe that export-based

jobs are the key to a prosperous economy.[21]

The state should set a target goal for the number of new export-based jobs created in the state. The focus should be on export-based jobs because they encompass the characteristics of "good jobs" for the state's economy and for the state's families. Export-based jobs and not specific sectors should be the emphasis. Export-based jobs can exist in a broad array of sectors, including biotechnology, high-technology, professional and business services, finance, higher education, and manufacturing. A long-term strategy focused on helping firms create the capacity to innovate within many sectors and types of jobs will help sustain a broad and diverse state economy. A careful review of existing evidence on which incentives are the most effective is needed, but the state should focus somewhat less on promoting specific industry sectors and more on helping to create good jobs across a range of sectors.

In addition, a manufacturing strategy is also needed, with specific goals. The manufacturing sector has been shrinking in Massachusetts. But, manufacturing still accounts for about 9 percent of state's jobs and is an important segment of the state's export base. The sector also is important at helping to build and preserve middle-class workers and families. Despite an overall loss of manufacturing jobs, there are areas of growth within this sector in our state. A closer look within the industry is needed to determine those manufacturing niches in which there has been job creation and where the state holds a competitive advantage. The future of manufacturing in our state likely includes knowledge-intensive jobs. State leaders should focus on managing the transition to the new areas of manufacturing and nourishing these areas of growth.

Create a Job Vacancy and Workforce Strategy

The quality of our workforce attracts and keeps companies in our state. Yet, cracks below the surface threaten our key competitive advantage. The state's latest job vacancy survey in the fourth quarter of 2006 recorded more than 90,000 job vacancies, the highest level since the survey began in 2002. The rising number of job vacancies in recent years is a mixed signal. While they indicate a willingness of more employers to hire workers, which is positive, they also indicate insufficient workers to meet employers' needs. One likely cause is structural, meaning that the occupational skills and educational background of the unemployed are not well matched to the available job openings. A strategy to more efficiently fill job vacancies is imperative. At the same time that filling available job vacancies represents low-hanging fruit, a lack of action could have long-term repercussions. If employers cannot find the workers they need, they will expand elsewhere, and new companies will be less likely to locate in our state.

Career centers have an important role to play in meeting the demand for workers and must be part of the solution. They are located across the state and are connected to the needs of local economies. There is, however, wide variation among career centers in the depth of their relationships with local employers and their responsiveness to employer needs. A regional analysis of the vacancies is needed along with the success efforts of the Career Centers to fill these vacancies. Their ability to fill vacancies should be monitored, and technical assistance from the state should be offered, as needed. To help fund these efforts, the state should target existing Workforce Training Fund monies and any new workforce training monies to addressing specific skill shortages problems in the state as identified by

the job vacancy surveys. As the state makes these investments, the career centers should be held to a very high standard of filling job vacancies.

To the extent that potential workers do not have the technical skills, educational skills, or English language skills to fill the available jobs, state colleges, community colleges, the adult education system, and vocational-technical schools must also be seen as pieces of the solution. State and community colleges should be nimble enough to partner with business to create curricula that provide workers with the necessary skills for the jobs. The public higher education system must make this a key strategic priority and provide the leadership, resources, and management accountability to get it done. Today, there is a wide variation in their effectiveness at performing this task. We also need a strategy to better leverage the resources of voc-tech schools. We need to expand the use of plant, equipment, and instructional capacity of voc-tech schools beyond the high school programs they offer. They could become part of the solution in raising the number of graduates in high-demand fields. The ability of voc-tech schools to offer technical associate degrees and certificates in high-demand fields should be considered. At the same time that the state makes new investments to create additional training capacity, there must be more accountability for improving graduation rates and to ensure existing training programs can generate workers able to fill job openings in shortage occupations. Programs that are not performing should be realigned or lose public monies.

THE STATE SHOULD SET A TARGET GOAL FOR INCREASING THE NUMBER OF EXPORT-BASED JOBS.

Finally, collectively, as a commonwealth, we need a renewed urgency around preK-12 education. This research shows how our state's economy has shifted even more toward a knowledge-based economy. This offers a lot of opportunity for individuals with the requisite skills and education, but the routes to economic success are becoming more narrow. The jobs of today and, increasingly, the jobs of tomorrow will require strong basic skills and an advanced degree. The Patrick administration has recently announced the Readiness Project, which is charged with putting together a long-term education plan. At the top of the list should be an action plan that will 1) reduce the number of high school dropouts; 2) maintain high standards in high school in English, science, technology, engineering, math, and other core subjects; 3) increase the number of students obtaining two- and four-year degrees; and 4) get the message out to students and their families that a high school degree is not sufficient to succeed in today's economy.

Create a Favorable Business Climate and Help Existing Companies Expand Here

A favorable business climate consists of a range of factors, including the ability to maintain fiscal stability, manage the cost of doing business, and generally make it easy for firms to do business in Massachusetts. Given the 351 cities and towns, navigating all the necessary local and state procedures can be unreasonably cumbersome for companies seeking to locate or expand in our state. In recent years, there has been a focus on streamlining permitting, simplifying regulations, and other efforts to make it easier for companies to locate here. With the establishment of the Business Resource Team by the Romney Administration, a single point of entry for companies was created, and substantial progress has been made.

Nonetheless, there is still more work to be done. Recent efforts by Governor Patrick and Attorney General Coakley to work with business leaders to review business regulations, looking for opportunities to simplify regulations without compromising public safety, are exactly the kind of initiatives the state should be aggressively pursuing.

A telling example is the way that leaders came together to seamlessly clear hurdles around permitting, site location, and other issues that helped to attract Bristol-Myers Squibb to the Devens location. This example should become the rule, not the exception. On a smaller scale, there are plenty of opportunities to help existing Massachusetts companies to expand their business here. While the news of a new company opening a facility in Massachusetts generates a lot of excitement, the bread and butter of job creation is helping companies already located in Massachusetts expand their existing business. Any Massachusetts company ready to grow should be a priority of state economic development leaders. Moreover, the state should publicly track its success rate at keeping jobs in Massachusetts and report numbers to the Legislature and the public.

There might also be cost savings and reform measures worthy of attention. Although the Commonwealth will never be a low-cost-of-business state, it should still continue to seek out opportunities to reduce the cost of doing business. Helping businesses find ways to control energy costs is critical. In addition, a reform agenda requires the relentless pursuit of results coupled with greater transparency and fiscal accountability for spending and taxing. For instance, enacting some common-sense reforms in workers' compensations laws in the early 1990s had a substantive effect on reducing business costs. Similarly, state leaders should review the state's unemployment benefits and policies to see if there are reasonable reforms to enact. A tradeoff might include reducing the cost of unemployment insurance in exchange for an increased investment in the skills development of incumbent workers. Reducing the cost of business and reforming practices send a positive message and help to build confidence of the private sector.

A positive business climate is, however, broader than just tangible policies alone. To many, Massachusetts still has a reputation as a bad place to do business. While some of this perception may be based on older policies, this view nonetheless lingers, and the state must take active steps to counter it. Strong leadership on this issue is essential. The message to companies here should be that the state values them, wants them to succeed, and will work collaboratively with them to make that happen. That message should be sent consistently to all businesses in all sectors across the state by all departments of state and local government.

A REFORM AGENDA REQUIRES THE RELENTLESS PURSUIT OF RESULTS COUPLED WITH GREATER TRANSPARENCY AND FISCAL ACCOUNTABILITY.

Develop a Regional Approach with An Urban Agenda

Regional economic conditions and needs vary considerably across the state. Efforts to develop strategies based on existing regional strengths are likely to bear the greatest fruit. The first step is to identify and build upon local strengths that give competitive advantages to companies doing business there. Every region has assets that can

serve as a foundation for economic growth. Location, quality of life, proximity to transportation, cost of living, cultural traditions, and the quality of the available labor force are all examples of potential strengths. The specific strengths of local economies will determine what kinds of growth opportunities are practical for a given community. Regions that foster industries that capitalize on existing strengths will succeed because those existing strengths can create competitive advantages.

State leaders should also develop an urban strategy for communities outside of Greater Boston. This research documents how the state's large cities are lagging the rest of the state in their ability to create new jobs. The Gateway Cities — the state's traditional mill and manufacturing cities — are of strategic importance to the overall Commonwealth's economic health. Yet, they share a set of common challenges around pathways to transitioning to the knowledge-based economy. Public and private higher education institutions have a key role in helping generate economic development in the Gateway Cities. Moreover, disincentives exist within current laws that make it difficult for these cities to move ahead. Working together, these cities should pursue a shared agenda to create incentives for investment and development.

Massachusetts has some advantages that are the envy of the nation. While the state is not going to be a state leader in job creation, neither should it be the national laggard. Our state needs a comprehensive and integrated strategy to create jobs, especially good jobs capable of supporting workers and their families. An effective strategy will be long-term, will be based on solid data about what works, will be insulated from political pressures, and will represent a shared vision between the Administration, the Legislature, and the business and labor communities. The time for such a plan is now. The future economic health of our Commonwealth depends upon it.

Endnotes

1. Our findings on jobs and the number of employed residents are based on data from the Current Employment Statistics (CES) and the Local Area Unemployment Statistics Program (LAUS). Our ranking of the state's performance in job creation is based on CES data, which measures the number of wage and salary jobs on the formal payrolls of private sector firms and government agencies. Because of underlying conceptual differences in these two data sources, the job creation numbers vary depending on the source of data.

2. The seven states that have not recovered all the jobs that they had at the peak of business cycle are: Connecticut, New York, Louisiana, Illinois, Ohio, Massachusetts, and Michigan. We base our analysis of job creation and job loss on time periods of the national business cycle as determined by the National Bureau of Economic Research. Much of our analysis starts at the peak of the national business cycle, which was the first quarter of 2001, and goes through the current time period, which at the time this research was being conducted was the end of 2006. We also analyze other time periods, including the peak of the business cycle to the start of the national jobs recovery (2001 QI-2003, August-October) and the start of the national jobs recovery to the current period (2003, August-October – 2006 QIV). In all three of these time periods, Massachusetts ranks at or near the bottom of the nation in terms of job creation. Because it is based on the nation's business cycle, we use the same time periods for all states. We also look at our 10 economic competitor states and at the other states in New England to offer specific comparisons with our peer states.

3. Sectors are defined using North American Industry Classification System (NAICS) codes. Based on its primary line of business, each establishment in the country is classified under a specific code. We follow the American Electronics Association's definition of the high-technology sector (see www.aeanet.org). The sector includes 16 industries within the fields of manufacturing, communications services, and software and tech services. For a full listing, see Table 23 on page 52 in the full report.

4. There is no single definition of the biotechnology sector. We rely on the national Biotechnology Industry Organization's (BIO) definition, which includes: drugs and pharmaceuticals; medical devices and equipment; physical, engineering, and biological research; and testing and medical laboratories. Similar to many other studies, we exclude agricultural feedstock and chemicals from our definition. The Massachusetts Biotechnology Council uses a slightly different and narrower definition of biotechnology. There is also no single definition for life sciences, but typically, it is broader in scope, including wholesale trade related to medical and hospital equipment.

5. This estimate is based on the Current Employment Statistics (CES) monthly payroll employment data, which measure the number of wage and salary jobs on the formal payrolls of private sector firms and government agencies. There are two main sources of data on jobs and employed residents—the Current Employment Statistics (CES) survey and the Local Area Unemployment Statistics program (LAUS). In recent years, there have been some large gaps in their estimates of employment changes in Massachusetts. From 2001 to 2006, the gap was 82,000 jobs, a gap that is equivalent to nearly 3 percent of state employment. There are some important conceptual differences between the two surveys, which help explain the different estimates. The CES counts formal payroll jobs and includes in-commuters who hold such jobs in our state but excludes people who are self-employed, independent contractors, many private household workers, and people who work off-the-books. In contrast, the LAUS survey provides estimates of all employed people who live in Massachusetts and would include self-employed workers, independent contractors, private household workers, and off-the-book workers if such informal jobs are reported to CPS interviewers.

6. We identify these economic competitor states based on the Massachusetts Technology Collaborative's list of "Leading Technology States" and other research on states with economies similar to the Massachusetts economy.

7. Western Massachusetts is composed of Berkshire, Franklin, Hampshire, and Hampden counties. For more information of the changing economic fortunes of geographic regions, see Andrew Sum, Paul Harrington, Neeta Fogg, Dana Ansel, *et. al.*, *The State of the American Dream in Massachusetts, 2002*. Boston: The Massachusetts Institute for a New Commonwealth, 2002.

8. We follow the American Electronics Association's definition of the high-technology sector. (see www.aeanet.org.). For a full listing of the industries comprising the sector, see Table 23 on page 52 in the full report.

9. There is some overlap between the high-technology and biotech sectors. The following four industries are included in both high-tech and biotech: NAICS 334510 – Electromedical Apparatus Manufacturing; NAICS 334516 – Analytical Laboratory Instrument Manufacturing, NAICS 334517 – Irradiation Apparatus Manufacturing., and NAICS 541380 – Testing Laboratories.

10. Within biotech, there are four key subsectors: 1) drugs and pharmaceuticals; 2) medical devices and instruments; 3) physical, engineering, and biological research; and 4) testing and medical laboratories. Massachusetts has a particularly strong comparative position in physical, engineering, and biological research, which is also the largest subsector of the biotech industry. In recent years, there have also been large gains in Massachusetts in testing and medical laboratories, which grew by 61 percent. Although the overall sector has grown since 2000, the industry shed manufacturing jobs within medical devices and instruments in recent years, both in Massachusetts and in the nation.

11. See *The State of the American Dream in Massachusetts, 2002* for a more detailed description of these structural changes in the Massachusetts economy.

12. Mark Muro, John Schneider *et al.*, *Reconnecting Massachusetts Gateway Cities: Lessons Learned and an Agenda for Change.* Boston: MassINC and Metropolitan Policy Program at the Brookings Institution, 2007.

13. We include all private sector jobs in Health Services (NAICS 621 Ambulatory Health Care Services, NAICS 622 Hospitals, NAICS 623 Nursing and Residential Care Facilities).

14. Despite this growth, the share of health care jobs located in Massachusetts declined slightly from 3.2 to 3.1 percent between 2001 and 2006, reflecting the state's declining share of the national population.

15. The recently released monthly job numbers show that the state lost another 600 manufacturing jobs in September 2007, while adding jobs in education and health services, professional services, and financial services.

16. It is important to note that labor, property, and land inputs are measured by their physical location in the state, not by the physical residence of the workers or of the owners of the capital and land. For instance, the output of a New Hampshire resident who commutes to Massachusetts for work is considered part of the GSP of Massachusetts.

17. Andrew Sum *et al.*, *Mass Economy: The Labor Supply and Our Economic Future*, MassINC and The Center for Labor Market Studies, December 2006.

18. Andrew Sum, Johan Uvin, Ishwar Khatiwada, Dana Ansel, *et. al. The Changing Face of Massachusetts*, Boston: The Massachusetts Institute for a New Commonwealth, 2005.

19. See *The 2007 State New Economy Index. Benchmarking Economic Transformation in the States* by the Information Technology & Innovation Foundation (www.innovationpolicy.org)

20. Barry Bluestone, "Sustaining the Mass Economy: Housing Costs, Population Dynamics, and Employment," The Center for Urban and Regional Policy, Northeastern University, May 2006.

21. The analysis of the importance of export-based jobs (or trade clusters) by Michael Porter of Harvard Business Schools and his colleagues illustrates the significance of export-based industries in generating economic growth.

I. INTRODUCTION AND OVERVIEW OF THE REPORT

The economic performance of a state or regional economy can be assessed with a number of different measures, including real output, employment, labor productivity, unemployment, the real wages and earnings of its workers, and per capita and family incomes. The job creation performance of a state or a region is among the most widely used measures by economic and business analysts, given its importance for a variety of other measures and the availability of timely and generally statistically reliable data on aggregate employment developments.[1] Job creation helps determine the level of employment opportunities available to a state's residents and the level of real output that will be generated during a given year. The industrial characteristics of those jobs and their productivity levels also will influence the occupational distribution of jobs, their educational and skill requirements, and the wages and earnings of its workers.[2]

Knowledge of the job creation performance of a state and its substate areas and the economic forces influencing its job-generating ability is indispensable for state and local economic development and workforce development policymaking and program planning. This study has been designed to track and critically assess the job creation performance of the Massachusetts economy between 1969 and 2006, with a major emphasis on wage and salary job creation from 1989 to 2000 and from 2001 to 2006. The analysis will cover the state jobs boom from 1992 to 2000, the steep job losses from early 2001 through early 2004, and the modest job recovery from 2004 to 2006. The major focus will be on the aggregate number of wage and salary jobs appearing on the formal payrolls of private sector employers and government agencies across the Commonwealth.[3] Comparisons of findings on job creation developments in Massachusetts will be made with those for all other states and the nation as a whole. Employment developments in a few key industrial sectors of the state, including high technology and biotechnology, also will be separately tracked and examined. The sources of payroll job growth and decline in Massachusetts over time, including changing state shares of national employment in a wide array of individual industries, also will be identified, and their implications for state policy will be briefly discussed.

Knowledge of real output developments in the state is also critical to gauging our overall economic performance.[4] Gross State Product (GSP) estimates from the U.S. Bureau of Economic Analysis (BEA) for the 1989-2000 period and the 2001-2005 period will be used to conduct this analysis, including the sources of real output growth over time in both the state and the nation. Labor productivity estimates based on the BEA real output data and the payroll employment data for both the state and the nation over the 2001-2004 period will be used to examine the links between real wage changes for wage and salary workers over this four year period. Nationally, the real weekly earnings of full-time wage and salary workers and production workers in the nonfarm private sector and in manufacturing industries failed to grow between 2000 and 2006 despite strong gains in labor productivity.[5] One section of this study will be devoted to identifying whether labor productivity gains in Massa-

LIMITED JOB CREATION IS A KEY FACTOR UNDERLYING OUTMIGRATION.

chusetts industries are positively linked to improvements in the real weekly earnings of the workers in these industries.

The job creation performance of the Massachusetts economy also has a number of important implications for demographic and labor force developments in the state. Over the 2000-2005 period, the state experienced very little growth in its overall population, and the size of the resident labor force was essentially unchanged, with actual declines taking place between 2002 and 2005.[6] High levels of domestic out-migration from the state between July 2001 and July 2006 were primarily responsible for these adverse population and labor force developments. The media and a number of demographic/economic analysts have often cited high housing costs in the state as a key factor underlying these out-migration developments, but they have not paid close attention to the effects of the dismal job creation performance of the state in encouraging residents to leave for better employment opportunities in other states. In the final empirical section of this study, we will identify out-migration developments in the state over the 2001-2006 time period and construct a set of multivariate statistical models to estimate the independent effects of payroll job changes and housing costs on the rates of net domestic migration across states.

THE SHARE OF THE NATION'S JOBS LOCATED IN MASSACHUSETTS HAS STEADILY DECLINED.

An Overview of the Report's Contents

Our study will begin with a review of the key employment, real output, and labor productivity concepts and measures underlying the findings appearing in this report as well as the data sources used to produce all of the employment, output, and productivity measures. This discussion will be followed by an analysis of payroll employment developments in the Commonwealth over two time periods: 1969-2000 and 2001-2006. Separate analyses of employment changes within each of these two time periods also will be presented. Findings on payroll job developments for the state as a whole will be complemented by an overview of employment changes in counties and selected large cities of the state during the 1990s and between 2001 and 2006.

To obtain an understanding of the forces influencing job creation/job loss in the state during the 1990s and the 2001-2006 period, we conducted a shift-share analysis of employment changes in the state. This technique allows us to disaggregate the sources of employment change into three categories: a national job growth effect, an industry mix effect, and a share effect, the last of which measures changes in the competitive position of state industries. The shift-share analysis will be followed by an examination of changes in employment in two key industrial sectors of the state's economy in the 1990s and in more recent years: high-technology industries (both manufacturing and services) and biotechnology industries. A comparison will be made of state employment estimates from the payroll survey with those from the Local Area Unemployment Statistics program, which is heavily based on findings from the CPS household survey in the state. The influence of changing work arrangements, including self-employment, independent contractor employment, and off the books workers, on employment estimates will be analyzed.

Our analysis of employment developments in the state will be supplemented with a review of findings on the number and industrial distri-

bution of job vacancies in the state from 2002 to 2006. Trends in job vacancy levels and job vacancy rates over this four year period will be described. The vacancy analysis will be followed by a review of real output and labor productivity developments in the 1990s and over the 2001-2005 period.[7] The links between labor productivity developments over the above time period and changes in the real weekly earnings of workers in Massachusetts and the U.S. will be reviewed.

Statistical links between the high levels of out-migration of Massachusetts residents over the 2001-2006 period and both payroll job developments and housing price changes in the state will be examined with the use of econometric techniques that model these relationships across all states. The final section of the report will provide a summary of key research findings and their economic development and workforce development implications for the Commonwealth in the years ahead.

Endnotes

1. For earlier assessments of the job creation performance of the Massachusetts and New England economies and their economic implications for workers and families, *See:* (i) Andrew Sum, Paul Harrington, Neeta Fogg, et al., *The State of the American Dream in Massachusetts, 2002*, Massachusetts Institute for A New Commonwealth, Boston, 2002; (ii) Andrew Sum, Neeta Fogg, Sheila Palma, et al., *The Northeast Region's Economy on the Eve of the Twenty-First Century: An Appraisal of the 1990s Record and the Challenges Ahead,* Teresa and H. John Heinz III Foundation, Washington, D.C., 2001; (iii) Andrew Sum, Anwiti Bahuguna, Neeta P. Fogg, et al., *The Road Ahead: Emerging Threats to Workers, Families, and the Massachusetts Economy*, Teresa and H. John Heinz III Foundation and The Massachusetts Institute for a New Commonwealth, Boston, 1998.

2. *See*: (i) Andrew Sum, Paul Harrington, Neeta Fogg, et al., *The Workforce Development Report for New England*, U.S. Department of Labor, Employment and Training Administration, New England Regional Office, Boston, 2005; (ii) Andrew Sum, Paul Harrington, Neeta Fogg, et al., *The State of the American Dream in Massachusetts, 2002...*

3. The wage and salary employment estimates are based on a monthly survey of economic establishments known as the Current Employment Statistics survey that is conducted by the Massachusetts Division of Unemployment Assistance. The findings from the monthly CES surveys are annually benchmarked to the Quarterly Census of Employment and Wages.

4. Andrew Sum, Ishwar Khatiwada, Mykhaylo Trubs'kyy, *The Real Output Performance of the Massachusetts Economy, 1989-2000*, Center for Labor Market Studies, Northeastern University, Boston, 2003.

5. For a review of national evidence on overall trends in labor productivity and the real weekly earnings of U.S. workers over the 2000-2006 period, *See*: Andrew Sum, Joseph McLaughlin and Paulo Tobar, *Who Stole Christmas? The Severed Link Between Labor Productivity and Real Wage Growth, 2000-2006*, Center for Labor Market Studies, Northeastern University, Boston, December 2006.

6. Andrew Sum, Ishwar Khatiwada, Joseph McLaughlin, et al., *Mass Economy: The Labor Force and Our Economic Future,* Massachusetts Institute for a New Commonwealth, Boston, 2006.

7. Our labor productivity measures will include both real output per worker and real output per hour of paid work.

II. JOB CREATION AND JOB LOSS, 1969-2006

The employment data for Massachusetts, other states, and the U.S. appearing in this monograph are based on a number of different data sources. The major source of employment data is the monthly survey of nonfarm payroll employment officially known as the Current Employment Statistics program (CES).[1] The CES survey in Massachusetts is conducted by the Massachusetts Division of Unemployment Assistance under a cooperative statistical program with the U.S. Bureau of Labor Statistics. The CES is an establishment-based survey that generates monthly estimates of the number of wage and salary workers on the formal payrolls of nonfarm employers in the private and public sectors. The CES provides a count of formal payroll jobs in these firms in Massachusetts regardless of the residence of the workers. Commuters into Massachusetts from surrounding states will be included in the count of CES payroll jobs in Massachusetts. The CES employment measure excludes farm employment, the self-employed, independent contractors, private household workers, and persons working without pay in a family owned business for 15 or more hours per week.[2] The CES also will exclude persons employed off the books in the informal or Black economy. The number of workers in the informal economy, including both native born workers and undocumented immigrants, appears to have increased in our state over the past five years (2000 to 2005).[3]

The second source of employment data is the ES-202 wage and employment data series of the Massachusetts Division of Unemployment Assistance and the U.S. Bureau of Labor Statistics.[4] The ES-202 employment data represent a complete count of wage and salary jobs on the payrolls of private sector firms and government agencies that are covered by the state and federal unemployment insurance laws. The ES-202 is an administrative data base, not an establishment survey. Firms and government agencies report employment and wage data on a quarterly basis to the Massachusetts Division of Unemployment Assistance. Quarterly and annual average data on employment by major industrial sector are available from the ES-202 data series for the state, labor market areas, counties, and individual cities and towns. Changes in the geographic distribution of covered wage and salary employment across the state also can be tracked with the ES-202 employment data. As was the case with the CES employment data, the ES-202 data represents a count of payroll jobs in firms and government agencies located in Massachusetts, not a count of employed residents. In-commuters of workers into Massachusetts from neighboring states have increased more rapidly than out-commuters over the past few decades, adding to payroll employment estimates for the state. The ES-202 data base also includes data on aggregate labor compensation paid to workers and managers in the form of wages, salaries, overtime pay, commissions, bonuses, and stock options. The ES-202 labor compensation data can be used to calculate average weekly and annual earnings of wage and salary workers in Massachusetts for the state as a whole, selected sub-state areas, and individual industries.

The third source of employment data for the state is generated by Local Area Unemployment Statistics program (LAUS). This statistical program provides monthly and annual average estimates of the size of the resident labor force, the number of employed, and the unemployed in the state, major labor areas, counties, and

cities and towns.[5] The LAUS employment data, however, do not provide any information on the demographic/socioeconomic characteristics of the employed in the state or the occupational and industrial characteristics of their jobs. The LAUS employment data will be supplemented with data from the monthly Current Population Surveys for the 2000-2005 period and the American Community Surveys of 2004 and 2005 to examine changes in employment over the past five years in self-employment, across educational attainment groups, and nativity status groups, industries of the state, and geographic areas of the state. The American Community Survey (ACS) is a national household survey conducted annually by the U.S. Census Bureau since 2000.[6] The national sample of households in the ACS survey has increased substantially over the past five years. The ACS survey utilizes a questionnaire very similar to the long form household questionnaire used in conducting the 2000 Census. During 2005, nearly 34,000 households across the state participated in the ACS survey.

Finally, real output data for states from the U.S. Commerce Department's Bureau of Economic Analysis will be used to track both aggregate output and labor productivity developments in the state during the 1990s and over the 2000-2005 period.[7] The Gross State Product (GSP) data from the Bureau of Economic Analysis for both the entire state economy and individual industrial sectors will be combined with data on payroll employment and annual hours of work to estimate annual labor productivity levels and track changes in labor productivity over the 1989-2004 period. The labor productivity data for industries will be used together with data on trends in real weekly and annual earnings by industry from the ES-202 survey to analyze the links between labor productivity growth and real earnings growth of Massachusetts workers during both the 1990s and in more recent years. The analysis will be used to determine whether the strength of the links between productivity growth and real wage growth have been reduced in recent years.

Payroll Job Growth in Massachusetts from 1969 to 2000: Cycles of Boom and Bust

To place the job creation performance of the Massachusetts economy from 2000 to 2006 in proper historical perspective, we have tracked payroll employment trends in Massachusetts during the 1970s, 1980s, and 1990s.[8] The job creation performance of Massachusetts during each of these three decades will be compared to those of the nation as a whole and to the other 49 states. The employment estimates are annual average estimates of nonfarm wage and salary employment in Massachusetts and each other state. The Current Employment Statistics program (CES) which was used to generate these employment estimates covers private sector firms (both for-profit and non-profit) and government agencies at the federal, state, and local level.[9]

During the 1969-1979 period, which included two national recessions (1970-1971 and 1974-1975), the Massachusetts economy generated 354,000 net new wage and salary jobs, representing a growth rate of just under 16 percent (Table 1). In comparison, the U.S. economy created nearly 20 million new jobs over this same time period, a spectacular growth rate of 28 percent. Massachusetts only ranked 45th among the 50 states on this job creation measure, but it still managed to capture 1.82 percent of all of the net new jobs produced by the nation's economy.

The Massachusetts economy experienced severe structural problems in the early- to mid-1970s, with large job losses in the manufactur-

Table 1:

Massachusetts' Payroll Job Creation Performance Over Selected Time Periods, 1969-2000 (Annual Averages)

TIME PERIOD	INCREASE IN WAGE AND SALARY EMPLOYMENT	MA JOB GROWTH RATE	U.S. JOB GROWTH RATE	MA RANKING AMONG 50 STATES	MA SHARE OF NATIONAL JOB GROWTH
1969-1979	354,000	15.7%	27.5%	45th	1.82%
1979-1989	515,000	19.8%	20.1%	23rd	2.85%
1989-2000	211,000	6.8%	22.0%	47th	0.89%
1969-2000	1,080,000	48.0%	86.9%	47th	1.76%

Source: (i). U.S. Bureau of Labor Statistics, Web site, CES Employment Statistics; (ii) Massachusetts Division of Unemployment Assistance, Web site, CES Employment Statistics.

Table 2:

Trends in Massachusetts Payroll Employment Over Selected Time Periods, 1969-1980

TIME PERIOD	ABSOLUTE CHANGE	MA CHANGE (PERCENT)	U.S. CHANGE (PERCENT)	MA-U.S.
1969-1971	-38,000	-1.7	1.2	-2.9
1973-1975	-60,300	-2.6	0.2	-2.8
1975-1980	381,200	16.8	17.4	-0.6

Table 3:

Trends in Massachusetts Payroll Employment Over Selected Time Periods, 1980-1990

TIME PERIOD	ABSOLUTE CHANGE	MA CHANGE (PERCENT)	U.S. CHANGE (PERCENT)	MA-U.S.
1980-1982	-12,300	-0.5	-0.9	+0.4
1982-1988	496,200	18.8	17.5	+1.3
1988-1990	-150,500	-4.8	1.3	-8.7

ing sector due to plant closings in the traditional manufacturing base and defense cutbacks resulting from the end of the Vietnam conflict. In both the recessionary periods of 1970-1971 and 1974-1975, the state experienced a much higher rate of job loss than the nation, and manufacturing employment declined by nearly 104,000, or 15 percent between 1969 and 1975.[10] Beginning in 1975, however, the state economy roared back, fueled by a strong expansion of new high-technology manufacturing industries, creating 381,000 net new wage and salary jobs between 1975 and 1980.[11] This represented a state job growth rate of nearly 17 percent over this five year period, falling only one half of a percentage point below the U.S. job growth rate over the same five year period (Table 2).

The decade of the 1980s represented a high water mark for overall Massachusetts job creation, the quality of the jobs created, and labor productivity gains.[12] Between 1979 and 1989, the Massachusetts economy generated 515,000 additional wage and salary jobs, representing a job growth rate of just under 20 percent, and came close to matching the U.S. job growth rate over the same time period (20%). Our state's ranking among the 50 states on this job creation measure was 23rd, and Massachusetts captured 2.85 percent of all of the net new wage and salary jobs generated by the national economy.

The early years of the 1980s were characterized by two back-to-back national recessions in 1980 and 1981-1982. Unlike the situation in the 1970s and again in the 1990s, the state weathered these recessions better than the nation. Aggregate wage and salary employment in Massachusetts fell by only 12,300, or 0.5 percent, between 1980 and 1982, as opposed to a near 1 percent decline in the nation (Table 3). From 1982 to 1988, the state's economy generated nearly 500,000 net new wage and salary jobs, representing a 19 percent growth rate in just six years, the best six year job creation performance in the state since the end of World War II. In just one year (1984), the state created 159,000 net new wage and salary jobs with very strong gains in construction, wholesale trade (including high-technology-related marketing offices and distribution), finance/

insurance, and private service industries.

In 1984, the local media heralded the existence of a job boom in Massachusetts that was pushing the state to full employment conditions in its labor markets well before the nation.[13] At mid-decade, the national press, including *Business Week*, proclaimed New England as the "in spot" for doing business, and a BLS economist described New England as experiencing an economic "rebirth." State and city political leaders, including Governor Dukakis and the mayor of Boston, began to refer to the "Massachusetts miracle" and the "economic renaissance" of Boston.[14] In the mid-1980s, it was claimed that the economic future of the nation was being created right here in Massachusetts.

The state's strong job creation performance during the 1980s was accompanied by an even more impressive performance in boosting labor productivity. Between 1979 and 1989, real Gross State Product (GSP) per hour of work in Massachusetts is estimated to have increased by 33 percent, ranking first among the 50 states.[15] Four other New England states (Connecticut, New Hampshire, Rhode Island, and Vermont) ranked among the top five states in labor productivity performance, a very impressive regional track record. The high gains in labor productivity in Massachusetts during the 1980s helped boost the median real annual earnings of workers during the decade by 15 percent, and women who worked 40 or more full-time weeks obtained an even larger gain in their median annual earnings (24%).[16] These gains in annual earnings in turn helped boost the median real incomes of Massachusetts families by 20 percent, far outpacing the gains for the typical family in the nation. The 1980s in Massachusetts represented a time period of fairly broad-based prosperity. The past two decades have been characterized by greater inequality in the sharing of the gains from economic prosperity, and job losses since 2001 have taken a substantial toll on less educated and lower income adults and families.

Unfortunately, the 1980s jobs boom in Massachusetts came to an end in early 1989 well before the national economic recession of 1990-1991 set in. Between 1988 and 1990, the state would lose more than 150,000 wage and salary jobs, a near 5 percent decline, while the nation added nearly 4 percent more jobs (Table 3). Job losses in the state would continue to pile up through 1992, with 320,000 wage and salary jobs lost between 1989 and 1992, representing a 10 percent decline in the state's wage and salary base in 1989 (Table 4). While the U.S. economy lost 1.1 million jobs in 1991, it began to recover jobs in 1992, and during that year it had 700,000 more jobs than it had in 1989.

From 1992 onward through the end of the decade, the Massachusetts economy produced new jobs each year, adding 531,000 net new positions over this eight year period, a gain of 19 percent, falling only slightly below the U.S. growth rate of 21 percent over the same time period (Table 4). Very strong job growth in construction, finance/insurance/real estate, transportation, business services including information services, and professional services helped create the job boom. In contrast to these favorable developments, overall manufacturing employment in Massachusetts

Table 4:

Trends in Massachusetts Payroll Employment Over Selected Time Periods, 1989-2000

TIME PERIOD	ABSOLUTE CHANGE	MA CHANGE (PERCENT)	U.S. CHANGE (PERCENT)	MA-U.S.
1989-1992	-320,000	-10.3	0.7	-11.0
1992-2000	531,500	19.0	21.2	-2.2

continued to decline over this period, dropping by nearly another 30,000.[17] There were a few positive signs of growth in selected manufacturing industries including pharmaceuticals and biotechnology.

For the 1989-2000 period as a whole, total nonfarm wage and salary employment in Massachusetts increased by just 211,000 or slightly below 7 percent (Table 1). The state's job growth rate was less than one-third as high as that of the nation (22%), and Massachusetts ranked 47th among the 50 states on this job creation measure. The state captured only 0.9 percent of all of the net new jobs created by the national economy between 1989 and 2000 less than one-third of its share in the prior decade and one-half of its share in the 1970s. This job creation performance over the past decade was the worst in the state over the 60 years for which payroll employment data are available at the state level.[18] But unfortunately the worst was yet to come.

While the state's overall job-generating performance during the 1990s decade (1989-1999) was quite weak in comparison to both the nation's job creation record during the same decade and the state's performance in the prior decade, labor productivity growth in the state remained strong. Between 1989 and 1999, real output per worker in Massachusetts increased by 24 percent, surpassing the growth of output per worker in the U.S. by 10 percentage points.[19] The state ranked fifth highest among the 50 states on this key labor productivity measure. Despite these strong gains in labor productivity, however, the median real annual earnings of full-time, year-round workers in Massachusetts is estimated to have declined by 7 percentage points between 1989 and 2000.[20] All of the earnings declines took place among Massachusetts workers with less than four years of college. Workers with at least a Bachelor's degree improved their real annual earnings over the past decade, and earnings gains were extremely concentrated at the top of the earnings distribution.[21] Earnings inequality rose considerably in the state during the 1990s, contributing to a sharp rise in household and family income inequality in the Commonwealth.

Payroll Employment Developments in Massachusetts from the Recession of 2001 to 2006

After eight consecutive years of strong payroll job growth from 1992 to 2000, nonfarm wage and salary employment growth in Massachusetts came to an abrupt end in early 2001 as the national recession set in. The National Bureau of Economic Research, the nation's official arbiter of business cycles, identified March 2001 as the beginning month of the recession of 2001. In the first quarter of that year, nonfarm wage and salary employment (seasonally adjusted) in Massachusetts peaked at just under 3.381 million (Table 5). Over the next three years, nonfarm payroll employment in Massachusetts would decline fairly steadily and strongly, not bottoming out until the first two months of 2004 when nonfarm wage and salary employment was estimated to be only 3.184 million, or nearly 200,000 jobs below its peak level in the first quarter of calendar year 2001. As will be revealed below, job losses were quite widespread across most industries and geographic areas of the state over this three year period.

Payroll employment in Massachusetts experienced renewed growth beginning in the late winter of 2004 and has picked up more steam over the past calendar year (2006). Still, during the October-December quarter of 2006, the ending time period of our jobs analysis, payroll employment stood at only 3.254 million, or 127,000 jobs below its cyclical peak of 3.381 million in 2001 I.

Over the same six-year period, nonfarm pay-

Table 5:

Trends in Non-Agricultural Wage and Salary Employment in Massachusetts and the U.S., 2001 I to 2006 October-December, Selected Time Periods (Numbers in 1000s, Seasonally Adjusted)

TIME PERIOD/ GEOGRAPHIC AREA	BEGINNING OF PERIOD	END OF PERIOD	ABSOLUTE CHANGE	PERCENT CHANGE
2001 I – 2006, October-December				
Massachusetts	3,381	3,254	-127	-3.8
U.S.	132,509	136,951	4,482	+3.4
2001 I – 2003, August-October				
Massachusetts	3,381	3,193	-188	-5.6
U.S.	132,509	129,931	-2,578	-1.9
2003 August – October to 2006 October – December				
Massachusetts	3,193	3,254	+61	+1.9
U.S.	129,931	136,951	+7,016	+5.4

Sources: (i) U.S. Bureau of Labor Statistics, CES employment data, web site; (ii) Massachusetts Division of Unemployment Assistance CES Statistics website.

roll employment in the U.S. increased by 4.482 million or 3.4 percent. Massachusetts has clearly lagged considerably behind the nation in creating net new jobs in the current decade (Table 6). Nationally, nonfarm payroll employment also peaked in the first quarter of calendar year 2001. Net job losses across the country continued to pile up through the late summer of 2003, with aggregate payroll employment bottoming out in August of that year. Between the first quarter of 2001 and the August-October period of 2003 when steady job growth was resumed, nonfarm wage and salary employment in the U.S. declined by nearly 2.58 million, a drop of 1.9 percent (Table 6). Within Massachusetts over the same time period, payroll jobs fell by 5.6 percent, nearly three times as fast as the job decline in the U.S. The state absorbed 7.3 percent of the net job losses of the nation over this time period, a highly disproportionate share since the state only accounted for 2.5 percent of all payroll jobs at the outset of this period.

Since the early fall of 2003, payroll employment in the U.S. has increased fairly steadily and strongly, with more than 7 million net new jobs being created by the last quarter of 2006. Over this slightly more than three year period, payroll employment in Massachusetts rose by only 61,000 or 1.9 percent vs. a 5.4 percent job growth rate for the nation (Table 5). Massachusetts captured only 0.8 percent of all of the payroll job gains (seasonally adjusted) in the nation between August-October 2003 and October-December 2006 (Table 6). Our state's poor job creation

Table 6:

Massachusetts Share of National Payroll Employment Changes for Selected Time Periods, 2001 I to 2006 IV

TIME PERIOD	U.S. EMPLOYMENT CHANGE	MASSACHUSETTS EMPLOYMENT CHANGE	MASSACHUSETTS AS PERCENTAGE OF U.S
2001 I – 2003 August-October	-2,578	-188	7.3
2003 August-October – 2006 IV	7,016	6	0.8
2001 I – 2006 IV	4,482	-127	<0

Chart 1:

Growth Rates of Non-Agricultural Wage and Salary Employment in the Top Five and Bottom Five Ranked States, 2001 I – 2006 October – December (in percent)

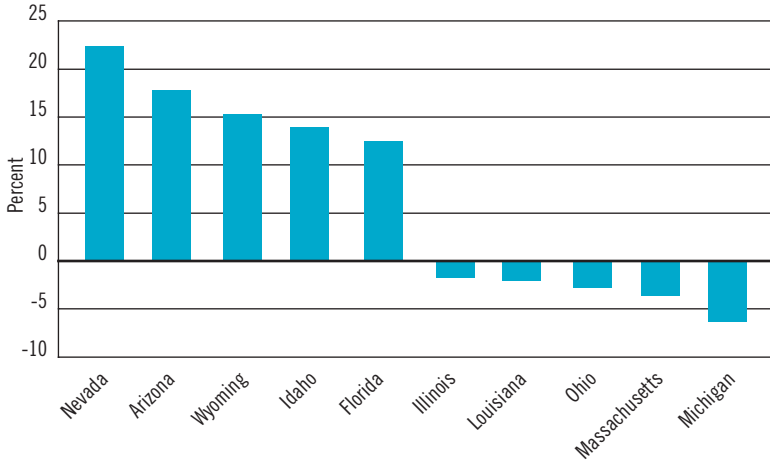
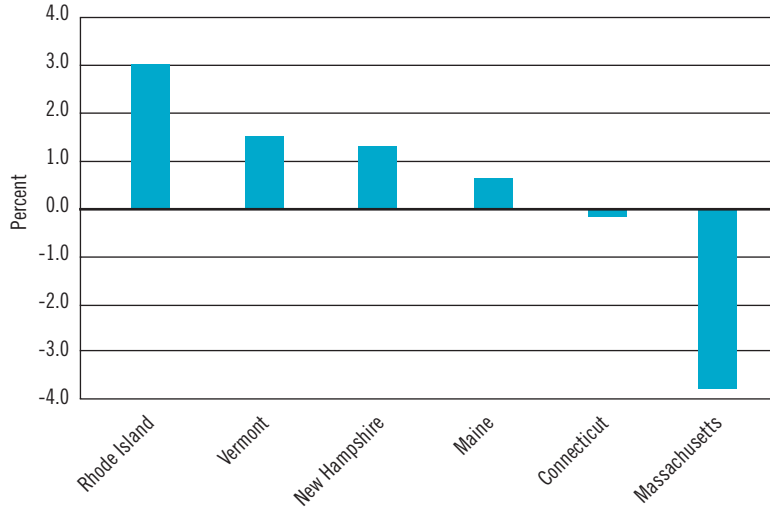


Chart 2:

Growth Rates of Non-Agricultural Wage and Salary Employment in New England States, 2001 I – 2006 IV (in percent)



record over the past six years is due to the effects of two sets of forces—a disproportionate share of job losses during the national economic recession of 2001 and the "jobless recovery" of 2002 and 2003[22] and a substantially below average share of the national jobs gains from the fall of 2003 through the fourth quarter of 2006.

Massachusetts' job-generating performance over the 2001 I – 2006 IV period was extremely weak in comparison to all other states except Michigan (Chart 1). Job growth rates of the 50 states varied markedly over this approximately six-year period, ranging from highs of 18 percent in Arizona and 23 percent in Nevada to lows of –3 to –6 percent in Ohio, Massachusetts, and Michigan. Four of the top five ranked states were in the Rocky Mountain region and the fifth was Florida. Massachusetts ranked 49th among the 50 states on this job growth measure, only outpacing Michigan whose –6 percent job decline was strongly influenced by the severe structural adjustment problems of the automotive industry.

How well did Massachusetts perform relative to the other New England states in creating payroll jobs over the past six years? Chart 2 displays growth rates of nonfarm wage and salary jobs in each of the six New England states between the first quarter of 2001 and the fourth quarter of 2006. Four of the six New England states, including the complete northern tier of states and Rhode Island, experienced modest job growth, with the size of these increases ranging from under 1 percent in Maine to a high of 3 percent in Rhode Island. Connecticut experienced a modest job loss (-0.2%) while Massachusetts trailed far behind (-3.8%). The job losses in Massachusetts and Connecticut out-weighted the job gains in the four smaller New England states over this six year period; thus, aggregate payroll employment in New England in the fourth quarter of 2006 still remained below its peak level in the first quarter of 2001.

How well have Massachusetts and the other New England states fared in generating net new jobs over the past three and one half years of renewed national job growth? To answer this question, we estimated job growth rates of each of the six New England states between the August-

October period of 2003 and the fourth quarter of calendar year 2006 and compared them to the job growth rates for the other 44 states. Over this three year period, each of the six New England states posted some net new job growth, with the rates of increase ranging from slightly under one percent in Maine and two percent in Massachusetts and Rhode Island to a high of 3.4 percent in New Hampshire (Chart 3).

None of the six New England states was able to generate a job growth rate close to the national average job growth rate of 5.4 percent over the August-October 2003 to October-December 2006 period. The top performing New England state (New Hampshire) only ranked 36th highest among the 50 states on payroll job growth measure. Each of the other five New England states ranked among the bottom ten performers with Vermont ranking 42nd, Connecticut 43rd, Rhode Island 46th, Massachusetts 47th, and Maine 49th (Table 7). Three of the bottom five performing states in terms of job generation were in New England. They were joined by Ohio and Michigan. The New England region as a whole has become a severe laggard in job creation over the past three and one half years. Of the nine geographic divisions, New England only ranked modestly ahead of the East North Central region, which includes Indiana, Illinois, Michigan, Ohio, and Wisconsin. Four of the five states in this geographic division also ranked among the bottom ten performers in net job creation over the above time period.[23]

Viewed over the long-run, the job creation performance of the Massachusetts economy has been quite dismal. During the 1980s economic boom, the job generating performance of the state matched that of the U.S., and the state ranked in the upper half of the distribution of job growth rates across states. Since 1988, however, the state's job performance has deteriorated considerably.

Chart 3:

Growth Rates of Non-Agricultural Wage and Salary Employment in Each of the New England States, 2003 August-October to 2006 October-December (in percent, Seasonally Adjusted Employment)

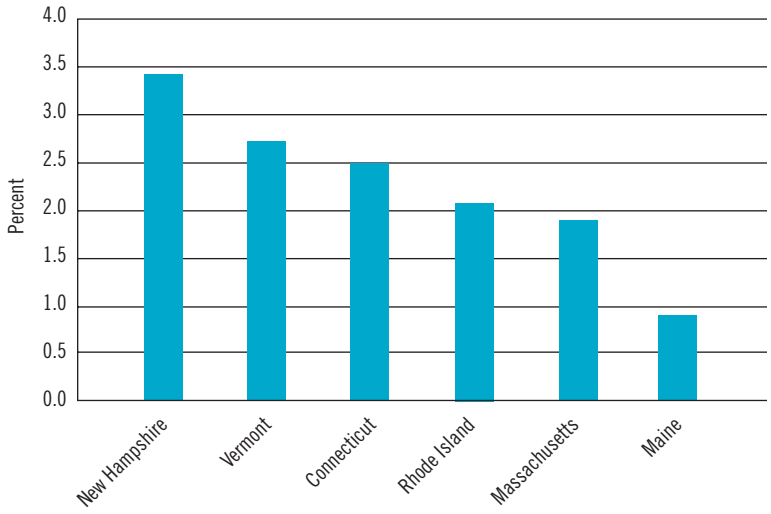


Table 7:

Rankings of Each of the New England States on their Payroll Job Growth Rates Between August-October 2003 and October-December 2006 (Seasonally Adjusted Employment Data)

STATE	GROWTH RATE	RANK
New Hampshire	3.4%	36th
Vermont	2.7%	42nd
Connecticut	2.5%	43rd
Rhode Island	2.1%	46th
Massachusetts	1.9%	47th
Maine	0.9%	49th
National Average	5.4%	

Source: U.S. Bureau of Labor Statistics, Current Employment Statistics by state, web site, tabulations by authors.

From 1988 to 2006, the U.S. economy created 30.8 million net new wage and salary jobs, a growth rate of nearly 30 percent over this 18-year period. In sharp contrast, total nonfarm payroll employment in the Massachusetts economy rose from only 3.138 million to 3.234 million over the same 16 year period (Table 8). This represented

Table 8:

Trends in Non-Agricultural Wage and Salary Employment in Massachusetts and the U.S., 1988 to March-May 2006 (Annual Averages in thousands)

GEOGRAPHIC AREA	1988	2006[1]	ABSOLUTE CHANGE	PERCENT CHANGE
Massachusetts	3,138	3,243	105	3.3
U.S.	105,345	136,174	30,829	29.3

Sources: (i) Massachusetts Division of Unemployment Assistance, "Current Employment Statistics Program," web site; (ii) U.S. Bureau of Labor Statistics, "CES Employment in the U.S," web site.

Chart 4:

Massachusetts Share of All Nonfarm Wage and Salary Jobs in the U.S., Selected Years 1988-2006 (Numbers in percent, Annual Averages)

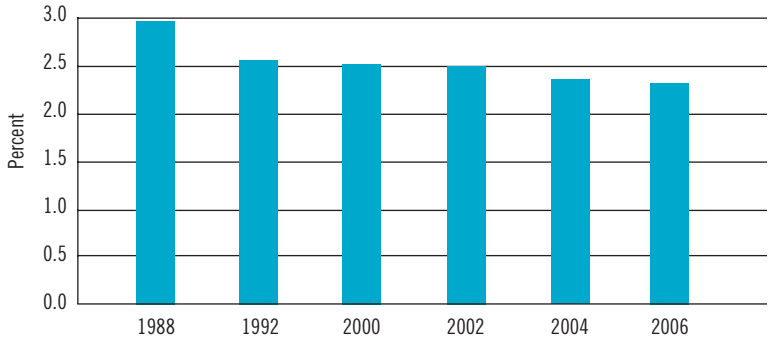
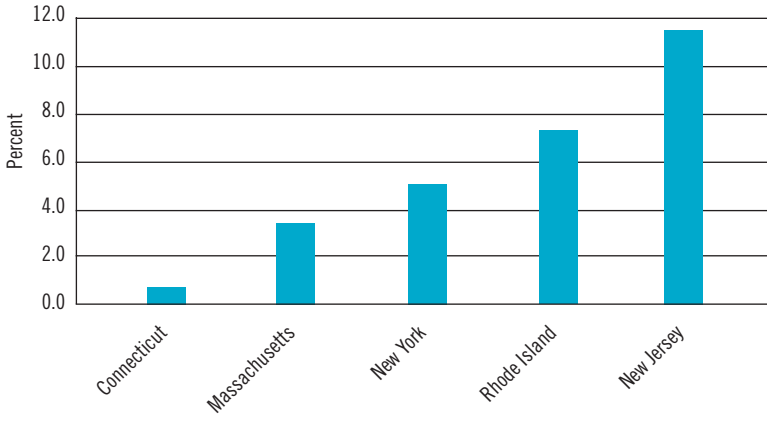


Chart 5:

Growth Rates in Nonfarm Wage and Salary Employment in the Five Slowest Growth States in the Nation Over the 1988-2006 Time Period (in percent)



a gain of only 105,000 net new jobs, an increase of just 3.3 percent. In one year (1984) during the 1980s boom, the state created more jobs (159,000) than it has over the past 18 years. Massachusetts captured only one-third of one percent of the new jobs generated by the national economy between 1988 and 2006.

As a consequence of our substantially below-average job growth rate, Massachusetts' share of national wage and salary employment declined sharply from 1988 to 2006. At the peak of the state's job boom in 1988, Massachusetts was the home for nearly 3 percent of all nonfarm wage and salary jobs in the nation (Chart 4). Due to the severe job losses in the late 1980s and early 1990s, by 1992, the state's share of national wage and salary jobs had declined to 2.57 percent. Strong job growth in the state from 1992 to 2000 allowed the state's national share of jobs to decline only modestly, falling to 2.52 percent in 2000. Since then, the state's share of jobs has declined steadily, reaching a new historical low of 2.38 percent in 2006 (Chart 4). To place this declining share in perspective, we conducted the following exercise. If the state had been able to maintain its 1988 share of national jobs in 2006, there would have been 4.058 million jobs in the state during that year vs. the actual 3.243 million jobs that existed, a difference of 815,000 jobs. The state has clearly lost its competitive edge in producing jobs over the past two decades.

To place Massachusetts' job generating performance over the 1988-2006 period into perspective, we estimated job growth rates for each of the other 49 states and ranked then from highest to lowest. The variability in state employment growth rates over this time period was extraordinarily high. The top five states (Nevada, Arizona, Idaho, Utah, and Colorado) all were located in the Rocky Mountain region. They achieved job

growth rates ranging from 59 percent in Colorado to 138 percent in Nevada. The bottom five states had job growth rates varying from under one percent in Connecticut to slightly over 11 percent in New Jersey (Chart 5). Massachusetts' job growth rate of 3.6 percent ranked it second lowest among the 50 states. All of the five bottom-ranked states were located in the Northeast region. The three southern New England states each fell in the bottom five, and each of the three Mid-Atlantic States fell in the bottom seven. The low growth of many of Massachusetts' neighbors in the Northeast has adverse consequences for the state economy since it reduces our ability to export more of our goods and services to them as both intermediate inputs and final goods and services for purchase by households, governments, and firms (capital equipment).

The New England region as a whole performed quite poorly in job creation over the past 18 years, a radical departure from its very strong job creation record in the 1980s. Four of the six New England states fell in the bottom ten, and the other two states (Vermont and New Hampshire) ranked 40th and 39th, respectively (Table 9). As will be revealed in a following section of this monograph, weak job creation has a number of other adverse effects on the state, including higher levels of domestic out-migration that reduce the size of the state's working-age population and its labor force. Low growth states are viewed by younger workers as less desirable places to live from an economic stand point, providing fewer opportunities for upward job mobility. Massachusetts in particular has experienced very high levels of domestic out-migration over the past six years, which has held down growth of the state's resident population and its labor force.

Table 9:

Nonfarm Payroll Employment Growth Rates 1988-2006 in Each New England State and Their Ranking Among the Fifty States

STATE	GROWTH RATE (IN PERCENT)	RANKING
New Hampshire	21.0	39th
Vermont	20.0	40th
Maine	16.6	41st
Rhode Island	7.4	47th
Massachusetts	3.6	49th
Connecticut	0.7	50th

Geographic Variations in Wage and Salary Employment Growth Across Massachusetts, 1992 to 2000 and 2001 to 2006.

All of the above discussions on wage and salary employment developments in Massachusetts over the 1980s, 1990s, and since 2001 have focused on the state as a whole. The economic fortunes of regions and counties of the state, however, varied markedly over the 1980s and 1990s.[24] Among the

Table 10:

Wage and Salary Employment Changes in Massachusetts by County, 1992-2000

	1992	2000	ABSOLUTE CHANGE	PERCENT CHANGE
Massachusetts	**2,728,621**	**3,275,135**	**546,514**	**20.0**
Nantucket	3,703	5,700	1,997	53.9
Dukes	4,748	7,159	2,411	50.8
Barnstable	66,779	88,589	21,810	32.7
Plymouth	132,051	166,482	34,431	26.1
Franklin	22,619	27,640	5,021	22.2
Bristol	182,168	221,539	39,371	21.6
Middlesex	697,720	846,931	149,211	21.4
Worcester	268,289	321,131	52,842	19.7
Essex	255,235	305,382	50,147	19.6
Norfolk	271,952	325,018	53,066	19.5
Suffolk	514,847	608,285	93,438	18.1
Hampshire	47,413	55,690	8,277	17.5
Hampden	182,754	204,303	21,549	11.8
Berkshire	55,790	61,531	5,741	10.3

Table 11:

Changes in Average Mean Real Weekly Wages of Payroll Workers in Massachusetts by County, 1992-2000 (in 2000 dollars)

	1992	2000	ABSOLUTE CHANGE	PERCENT CHANGE
Massachusetts	**$702**	**$852**	**150**	**21.4**
Middlesex	770	1,008	238	31.0
Suffolk	854	1,091	237	27.7
Nantucket	555	658	103	18.6
Norfolk	700	829	129	18.5
Essex	644	754	110	17.0
Worcester	625	711	86	13.8
Barnstable	513	572	59	11.5
Dukes	487	541	54	11.0
Plymouth	598	654	56	9.4
Bristol	546	594	48	8.8
Hampden	585	619	34	5.7
Berkshire	572	600	28	4.9
Hampshire	546	567	21	3.8
Franklin	520	530	10	1.8

Table 12:

Changes in Wage and Salary Employment in Massachusetts Counties From 2001 I-II – 2006 I-II

	1992	2000	ABSOLUTE CHANGE	PERCENT CHANGE
Massachusetts	**3,291,900**	**3,168,382**	**-123,518**	**-3.8**
Nantucket	4,812	5,514	703	14.6
Plymouth	166,482	175,403	8,921	5.4
Hampshire	56,434	58,114	1,680	3.0
Dukes	6,569	6,759	190	2.9
Barnstable	86,053	88,464	2,412	2.8
Berkshire	61,644	61,808	164	0.3
Bristol	220,075	219,135	-940	-0.4
Worcester	323,048	318,167	-4,881	-1.5
Franklin	27,510	26,978	-531	-1.9
Norfolk	327,498	318,440	-9,058	-2.8
Hampden	205,100	198,164	-6,936	-3.4
Essex	308,275	294,768	-13,507	-4.4
Suffolk	607,885	566,176	-41,709	-6.9
Middlesex	859,652	795,285	-64,367	-7.5

fastest growing areas of the state in the 1990s were the Cape and Islands followed by major segments of the Greater Boston region (Plymouth and Middlesex Counties) while job creation and real wage growth in the western region of the state lagged considerably behind. In this section of the study, we will track wage and salary job growth for individual counties and for 18 large cities across the state during the labor market boom years of the 1990s and over the 2001-2006 period. The findings on employment changes are based on the ES-202 employment and wage reports submitted by employers covered by the provisions of the state unemployment insurance laws. These are complete counts of jobs, not sample surveys.

As revealed earlier, the state economy underwent a substantial economic downturn between 1988 and 1991 with steep job losses taking place through 1992. Over the four-year period, 1988-1992, aggregate wage and salary employment in the state declined by 340,000, or nearly 11 percent.[25] From 1992 through 2000, however, ES-202 payroll employment in the state increased steadily and strongly rose by 546,000 or nearly 20 percent over this eight-year period. How was this job growth spread across the state's 14 counties over the 1990s labor market boom?

Each of the state's 14 counties experienced double-digit job growth over the 1992-2000 period; however, the rates of job growth varied considerably across counties, ranging from lows of 10 to 12 percent in Berkshire and Hampden Counties in the west region to highs of nearly 33 percent in Barnstable County and 51 to 54 percent in the two small Island Counties (Dukes and Nantucket) (Table 10). Job growth was quite strong in all counties in the southeast region with Bristol County characterized by a nearly 22 percent job growth rate and firms/government

agencies in Barnstable County boosting their payroll employment levels by nearly one-third. Other counties with above-average growth rates were Plymouth and Middlesex Counties in the Greater Boston area and Franklin County in the western region.

Despite job growth in each of the four western counties between 1992 and 2000, their combined employment in 2000 still fell slightly short of their wage and salary employment levels at the end of the 1980s.

During the job boom from 1992-2000, the mean real (inflation adjusted) weekly wages of payroll workers in Massachusetts increased by slightly more than 21 percent, boosted by strong growth in labor productivity (Table 11).[26] The growth rates in real weekly earnings varied quite considerably across counties of the state, ranging from lows of 1.8 to 5.7 percentage points in the four western counties of the state to highs of nearly 28 percent in Suffolk and 31 percent in Middlesex Counties. These geographically divergent gains in the real weekly earnings of wage and salary workers were accompanied by large variations in the growth rates of real per capita personal incomes of residents of counties over the 1990s.[27]

Following the end of the state economic boom in early 2001 through the first half of 2006, the economic fortunes of most of the state's counties changed dramatically (Table 12). Six of the state's fourteen counties, including Plymouth, Barnstable, and the two island counties, managed to experience some modest job growth while the other eight counties, including the five counties with the most jobs in 2001, were characterized by job losses. In the first half of calendar year 2006, wage and salary employment levels in Hampden, Essex, Suffolk, and Middlesex Counties were 3.4 to 7.5 percentage points below those prevailing

Table 13:

Changes in Wage and Salary Employment in Massachusetts Counties Between 2004 I-II and 2006 I-II

	2004	2006	ABSOLUTE CHANGE	PERCENT CHANGE
Massachusetts	**3,120,360**	**3,168,382**	**48,022**	**1.5**
Nantucket	5,023	5,514	491	9.8
Plymouth	169,862	175,403	5,541	3.3
Hampshire	56,511	58,114	1,603	2.8
Middlesex	775,812	795,285	19,473	2.5
Suffolk	553,676	566,176	12,500	2.3
Berkshire	60,901	61,808	907	1.5
Norfolk	315,222	318,440	3,218	1.0
Essex	292,392	294,768	2,376	0.8
Worcester	315,907	318,167	2,260	0.7
Bristol	218,424	219,135	711	0.3
Hampden	197,592	198,164	573	0.3
Franklin	27,053	26,978	-74	-0.3
Barnstable	88,826	88,464	-362	-0.4
Dukes	6,793	6,759	-34	-0.5

Table 14:

Changes in Wage and Salary Employment in Select Large Cities and Towns From 2001 I-II to 2006 I-II

	2001	2006	ABSOLUTE CHANGE	PERCENT CHANGE
Brockton	37,559	38,800	1,241	3.3
New Bedford	36,979	37,309	330	0.9
Quincy	46,248	45,935	-313	-0.7
Pittsfield	26,649	26,035	-615	-2.3
Lynn	25,216	24,560	-656	-2.6
Worcester	101,281	98,219	-3,063	-3.0
Lowell	34,683	33,185	-1,498	-4.3
Springfield	79,831	76,019	-3,812	-4.8
Lawrence	24,175	22,556	-1,619	-6.7
Boston	583,304	541,969	-41,335	-7.1
Fall River	40,357	37,054	-3,303	-8.2
Andover	35,121	32,215	-2,906	-8.3
Cambridge	114,271	104,143	-10,128	-8.9
Fitchburg	14,733	13,394	-1,339	-9.1
Burlington	40,562	35,870	-4,692	-11.6
Waltham	62,850	52,975	-9,875	-15.7
Attleboro	22,245	18,681	-3,564	-16.0
N. Andover	18,795	13,687	-5,108	-27.2
Total All 18 cities	**1,344,856**	**1,252,602**	**-92,254**	**-6.9**

Table 15:

Unemployment Rates In Select Cities of Massachusetts, 2005 (in percent)

	UNEMPLOYMENT RATE
Springfield	12.8
New Bedford	10.7
Boston	9.1
Fall River	8.7
Worcester	8.3
Brockton	7.8
Lynn	6.7
Lowell	5.3
Cambridge	4.7

Source: American Community Survey, 2005, U.S. Census Bureau, tabulations based on findings on the Census Bureau website.

Table 16:

Changes in Wage and Salary Employment in Select Large Cities and Towns From 2004 I-II to 2006 I-II

	2004	2006	ABSOLUTE CHANGE	PERCENT CHANGE
Burlington	32,774	35,870	3,095	9.4
Cambridge	99,654	104,143	4,489	4.5
N. Andover	13,221	13,687	465	3.5
Boston	529,755	541,969	12,214	2.3
Waltham	51,955	52,975	1,021	2.0
Lowell	32,550	33,185	635	2.0
Brockton	38,084	38,800	716	1.9
New Bedford	36,634	37,309	675	1.8
Quincy	45,660	45,935	275	0.6
Worcester	97,798	98,219	421	0.4
Pittsfield	25,938	26,035	97	0.4
Lynn	24,483	24,560	77	0.3
Lawrence	22,529	22,556	26	0.1
Andover	32,289	32,215	-74	-0.2
Springfield	77,371	76,019	-1,352	-1.7
Fitchburg	13,738	13,394	-344	-2.5
Fall River	38,608	37,054	-1,554	-4.0
Attleboro	19,680	18,681	-999	-5.1
Total All 18 cities	**1,232,720**	**1,252,602**	**19,882**	**1.6**

in the first half of calendar year 2001. The counties comprising the Greater Boston area fared far more poorly over the past six years than they did during the boom of the 1990s.

As noted earlier, wage and salary job growth in the state resumed during the first few months of 2004. Between the first half of 2004 and the first half of 2006, the number of wage and salary jobs in the state increased by 48,000 or 1.5 percent (Table 13). All but three of the state's counties (Barnstable, Dukes, and Franklin) generated some job growth over this two-year period, with Suffolk, Middlesex, Hampshire, and Plymouth counties generating job growth rates of 2.3 percent to 3.3 percent. Employment levels in Middlesex and Suffolk counties in the first half of 2006, however, remained well below those of the first half of 2001.

Many of the state's large cities absorbed above-average rates of job loss over the past six years (Table 14). Of the large cities, only two (Brockton and New Bedford) managed to generate some positive job growth between the first half of 2001 and 2006. In eight cities, job losses over this time period exceeded 8 percent, and four of the cities (Burlington, Waltham, Attleboro, and North Andover) encountered job losses in the double-digits, ranging from –11.6 to –27.2 percent.[28] In the eight cities with the largest number of net job losses, the absolute declines ranged from –3,000 to –3,300 in Worcester and Fall River to highs of approximately –10,000 in Waltham and Cambridge and –41,000 in the city of Boston. Nearly 80,000 wage and salary jobs were lost in these eight cities over the 2001 I-II to the 2006 I-II time period. These eight cities alone accounted for nearly two-thirds of the wage and salary job losses across the entire state over this five-year time period—a highly disproportionate share.

The substantial job losses in most of the

big cities pushed up their unemployment rates sharply during the first half of the decade. In 2005, of the eight cities for whom unemployment data were available from the 2005 ACS surveys, five had unemployment rates of 8 percent or higher, and two of them (New Bedford and Springfield) had double-digit unemployment rates (Table 15).[29] The ACS surveys based on questionnaires completed by households typically yielded unemployment rates for these eight cities several percentage points higher than those generated by the state's Local Area Unemployment Statistics (LAUS) program, which are based on formulas dependent on administrative data such as unemployment insurance clams data. Labor market problems in the state's largest cities in 2005 appear to be worse than those indicated by the official unemployment statistics.

How have the state's large cities fared in creating jobs since early 2004? To answer this question, we tracked changes in covered wage and salary employment levels in the large cities from the first two quarters in calendar year 2004 to the first two quarters in calendar year 2006 (Table 16).[30] Of these 18 selected cities, wage and salary jobs increased in 12, remained constant in Lawrence, and declined in five cities (including Attleboro, Fall River, Fitchburg, and Springfield).

The net gain in wage and salary employment in these 18 cities was just under 20,000, yielding a job growth rate of 1.6 percent over this two-year period. This rate of job growth was nearly identical to that of the entire state (1.5%) over the same two-year period. As a consequence of their considerably steeper job losses over the 2001-2004 period (a net loss of –112,000), these 18 cities continued to lag behind the rest of the state in job creation for the entire 2001-2006 period. Teens and young adults (20-24-year-olds) in these larger cities have been particularly adversely affected by the substantial weakening in their local job markets over the past six years, experiencing above-average declines in their employment rates.

Endnotes

1. For a more detailed review of the employment concepts and measures in the monthly payroll employment surveys conducted by states and the U.S. Bureau of Labor Statistics, *See*: U.S. Bureau of Labor Statistics, *Employment and Earnings, January 2006*, "Appendix B," U.S. Government Printing Office, Washington, D.C., 2006.
2. The CPS household survey does include these groups of employed persons in its employment measure. The CPS, however, is an estimate of employed residents (16 and older), and counts each person once regardless of the number of jobs they may hold. Multiple job holders with two wage and salary jobs will be counted twice on the payroll survey.
3. Paul Harrington and Andrew Sum, "As Jobs Go Off the Books, Immigrants Edge Out Some Native Born Workers," *CommonWealth* Magazine, Winter 2006, pp. 83-90.
4. The employment and wage data collected by the ES-202 program are described more fully in the *Employment and Wages* publications of the U.S. Bureau of Labor Statistics. *See*: U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Wages: 2002*, U.S. Government Printing Office, Washington, D.C., 2004.
5. The LAUS labor force and employment estimates at the state level are annually benchmarked to the findings of the Current Population Survey. Unfortunately, the monthly sample of state households interviewed as part of the national CPS household survey has declined substantially since the mid-1990, falling from more than 2,100 households per month in 1995 to less than 1,000 households per month in the past two years.
6. For a review of the design features and purposes of the American Community Survey and the content of the ACS questionnaire, *See*: U.S. Bureau of Census website, www.census.gov.
7. For a review of Gross State Product concepts and measures, the state's performance in increasing real output during the decade of the 1990s, and labor productivity developments in Massachusetts, *See:* (i) Ishwar Khatiwada, Andrew Sum, and Mykhaylo Trubs'kyy, *The Real Output Performance of the Massachusetts Economy, 1989-2000: Trends in the Level and Industrial Composition of Real Output and Their Implications for Future Economic Development and Workforce Development Policies*, Center for Labor Market Studies, Northeastern University, Boston 2002.

8. The beginning and ending years for each of our three time periods (1969-1979, 1979-1989, and 1989-2000) were cyclical peak years in the national economy. The U.S. economy experienced national recessions in 1970, 1980, and 2001.

9. The CES employment counts represent an estimate of wage and salary jobs in private sector firms and government agencies located within the state regardless of the location of the residence of the workers. Jobs held by commuters from Rhode Island into Massachusetts will count as wage and salary positions within Massachusetts.

10. For a review of employment and unemployment developments in Massachusetts during the first half of the 1970s, *See*: Andrew Sum and Paul Harrington, *Unemployment in Massachusetts: A Critical Assessment of Its Magnitude, Nature, and Causes,* Report Prepared for the Massachusetts Special Legislative Commission on Unemployment, Massachusetts Legislature, Boston, 1975.

11. For a review of the characteristics of high technology industries in Massachusetts and the forces influencing their development and economic fortunes in our state in the late 1970s and 1980s, *See*: (i) Paul Harrington, Marilyn Boyle, and Andrew Sum, High Technology Careers in Massachusetts, Massachusetts Department of Employment and Training, Boston, 1986. (ii) Robert Lampe (Editor), The Massachusetts Miracle, MIT Press, Cambridge, 1989.

12. For a comprehensive appraisal of labor market developments in Massachusetts and New England during the decade of the 1980s, *See*: Andrew Sum, Paul Harrington, and Neeta Fogg, *New England Labor Markets During the Miracle Decade of the 1980s*, Center on Education and the Economy, Northeastern University, Boston, 1992.

13. *See:* (i) Jonathan Kaufman, "Bay State in the Midst of A Job Boom," *Boston Sunday Globe*, August 5, 1984, pp. 1., 30; (ii) Brad Pokoray, "Jobs Go Begging in New Hampshire," *Boston Sunday Globe*, August 5, 1984, pp. 30.

14. For favorable reviews of Massachusetts economic performance in the first half of the 1980s, *See*: (i) "Business Fads," *Business Week*, January 20, 1986; (ii) Philip L. Rones, "An Analysis of Regional Employment Growth, 1973-85," Monthly Labor Review, July 1986, pp. 3-14; (iii) Robert Lampe (Editor), *The Massachusetts Miracle*, MIT Press, Cambridge, 1988.

15. For a more comprehensive analysis of real output and labor productivity developments during the 1980s, *See*: Andrew Sum, Neeta Fogg, Mykhaylo Trubskyy, and Sheila Palma, *The Northeast Region's Economy on the Eve of the Twenty-First Century*, Teresa and H. John Heinz III Foundation, Boston, 2001.

16. Andrew Sum, Paul Harrington, Neeta Fogg, et al., *The State of the American Dream in Massachusetts, 2002*, "Chapter 4: The Annual Earnings of Workers, 1980-1999."

17. Andrew Sum, Paul Harrington, and Neeta Fogg, *The State of the American Dream in Massachusetts, 2002,*

18. Over the 1959-1969 period, Massachusetts created just under 370,000 wage and salary jobs, representing 2.2 percent of all new jobs across the country.

19. Output per worker in each state was measured by dividing the value of real Gross State Product (GSP) by the annual average number of wage and salary workers employed on the formal payrolls of private sector firms and government agencies.

20. Andrew Sum, Paul Harrington, Neeta Fogg, et.al., *The State of the American Dream in Massachusetts, 2002*, "Chapter 4."

21. Mean annual earnings in Massachusetts increased by nearly 10 percent over the decade with more sizeable gains at the top decile of the distribution.

22. The national recession officially ended in November 2001 and real output growth resumed in the fourth quarter of 2001. Payroll employment growth, however, did not begin steadily until the early fall of 2003; thus, a number of labor market analysts dubbed the economic recovery of 2002 and 2003 as a "jobless recovery". *See*: L. Josh Bivens and Christian Weller, "The Causes of the Job Loss Recovery," Challenge, March-April 2005, p. 23-47.

23. Illinois was the only of the five states in this region to make it out of the bottom ten. Illinois ranked 37th highest among the states.

24. For a more detailed review of employment and real earnings developments in Massachusetts by region and county within the state over the 1989-2000 period, *See*: Andrew Sum, Paul Harrington, Neeta Fogg, et al, *The State of the American Dream in Massachusetts, 2002*, Massachusetts Institute for A New Commonwealth, Boston, 2002.

25. These estimates are based on the findings of the Current Employment Statistics program (CES) and will differ slightly from those generated by the ES 202 program of wage and salary employment covered by the state unemployment insurance laws.

26. Between 1989 and 1999, real output per worker in Massachusetts increased by 24 percent, outpacing productivity growth in the nation as a whole by 10 percentage points. Massachusetts ranked fifth highest among the 50 states on this labor productivity measure. These productivity growth rates varied considerably across industrial sectors of the state, accompanied by substantial variability in real annual wages per worker across industries of the state. Within the high productivity industries, there was substantial variability in annual earnings across workers.

27. Andrew Sum, Paul Harrington, Neeta Fogg, et. al., *The State of the American Dream in Massachusetts 2002*. In several of the counties with high growth in average weekly earnings and per capita personal incomes, median household and family incomes either grew more slowly or declined during the 1990s, suggesting a sharp rise in income inequality.

28. North Andover was adversely affected by the closing of the Lucent Technology plants in their city. *See*: Peter J. Howe, "Lucent to Cut up to 20,000 More Jobs", *The Boston Globe*, July 25, 2001, pp.A-1, F-5.

29. The unemployment rates from the ACS survey are based on questionnaires completed during all 12 months of 2005 but not at uniform rates per month. The ACS unemployment concepts are based on somewhat more liberal definitions of unemployment than those from the CPS surveys.

30. At the time of the writing of this report, the second quarter 2006 ES-202 employment data were the most recently released by the Massachusetts Division of Unemployment Assistance.

III. SHIFT-SHARE INDUSTRY ANALYSIS

The creation of new, additional employment opportunities for its resident population over time is a key indicator of the economic success of a state or geographic region. Strong growth in employment generally results in the improvement of a wide array of economic indicators at the state level, and the opposite holds true when the number of jobs declines. Knowledge of the sources of growth or decline in the number of jobs in a state is indispensable for both labor market analysis and economic development planning and policymaking. Current and past trends in the aggregate level of employment in a state can be disaggregated into three different components with the use of an analytical tool developed by urban and regional economists known as shift-share analysis.[1] Shift-share analysis allows us to divide a state's employment growth (decline) into the following three components: the growth or loss in state employment that would be expected due to the growth of jobs in the national economy; the job growth/loss due to the industry composition or mix of jobs at the state level; and the change in the number of state jobs due to changes in the share of jobs in each national industry that were captured by the state (i.e., changing share effects). The latter factor is influenced by changes in the competitive advantage of the state in each industry over time. Rising shares indicate an increase in a state's competitive position while declining shares indicate a deterioration in the state's competitive position.

The following analysis of employment developments by industry in Massachusetts is based on the ES-202 administrative data bases of the Massachusetts Division of Unemployment Assistance and the U.S. Bureau of Labor Statistics. The monthly and annual employment data from the ES-202 system represent a complete count of wage and salary jobs in private firms and government agencies that are covered by the provisions of federal and state unemployment insurance laws. The employment data represent wage and salary jobs on the formal payrolls of these firms. Independent contractors and the self employed as well as "off the books" workers are excluded from the job totals. We have conducted a shift-share analysis of employment growth in Massachusetts for three different time periods based on the ES-202 data: 1992-2000, 2001-2004, and 2004-2006. Although all of the analyses are based on data from the ES-202 employment series, there are some differences in the features of the data utilized in these different time periods. For the first period (1992-2000) we have used employment data by industry at the four-digit and three-digit level of industry detail for private industries based on the previous Standard Industrial Classification System (SIC) coding system. For the other two time periods, we have analyzed employment data for two digit and three digit industries based on the current North American Industry Classification System (NAICS). In the analysis of the data for the 2001-2006 time period, we expanded the number of industries covered in the manufacturing sector by including three-digit industries for this sector only. The inclusion of this more detailed set of industries allows us to identify the sources of the continuing and significant loss of manufacturing jobs, including high-technology manufacturing positions in Massachusetts, which have had negative multiplier effects on the rest of the state economy.

Shift-share Analysis of Employment Developments in Massachusetts

As discussed in the preceding section, shift-share analysis can be used to analyze the sources of employment changes in the state of Massachusetts for each time period. This procedure makes it possible to disaggregate the change in employment in the state into three components: the national growth effect, the industrial mix effect, and the state share effect. The national growth effect measures the change in total and individual industry employment that is attributable to overall employment changes in the nation. In other words, if the nation is experiencing employment growth at a rate of X percent, it is expected that this national growth effect will have a positive effect on the state's overall employment by X percent. To calculate the national growth component, the overall national employment growth rate is applied to each of the industry sectors included in the analysis. The second component, the industry mix effect, represents the level and share of the employment change that is due to a state's industrial job composition. A state with a favorable industry mix will have an above average job growth rate, holding its competitive share constant. The industry mix effect represents the change in a given state industry's employment level (e.g. construction) due to the growth or decline of employment in the same industry nationally, and its value is obtained by multiplying the difference between the national employment growth rate of a specific industry and the overall national job growth rate by the level of employment in the state in this industry during the base period. If the industry nationally grows at a rate above the national average, it will have a positive effect on employment growth in the state. The final component of shift-share analysis, the state share, describes the degree to which state economic factors are the causes of employment change in the state. Some states will either gain or lose competitive advantage that makes them experience a larger or smaller increase in employment in a given industry than other states. The state share captures the difference between the state and national growth rate of employment for a given industry. A rising state share implies that the state has a competitive advantage over other states in the nation in a particular industry or set of industries. This last component of job growth is important because it will allow us to identify whether the industries gaining or losing employment are doing so as a result of the state's changing competitive advantage in a given industry.

A RISING SHARE IMPLIES A COMPETITIVE ADVANTAGE, WHILE A DECLINING ONE INDICATES DETERIORATION.

From 1992 to 2000, both the Massachusetts and U.S. economies experienced a labor market boom that generated a substantial number of net new jobs. During this time period, the private sector in Massachusetts added nearly 500,000 new jobs to their formal payrolls, with particularly strong job growth in security brokers and dealers, business services, professional services and the construction industries (Table 17).[2] In our shift-share analysis of employment changes for this time period, we included 131 individual SIC industrial sectors (See Appendix A). Overall, Massachusetts employment growth over this time period was primarily caused by the economic boom of the U.S. economy. Based on the findings of our shift-share analysis, nearly all of the net increment in wage and salary jobs in the state came from the national growth component, which accounted for 110 percent of the total growth in employment. Our analysis also indicates that there was a small

Table 17:

Shift-Share Analysis of Changes in Massachusetts Wage and Salary Employment by Major Industrial Sector, 1992-2000

INDUSTRY	1992	2000	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
TOTAL, ALL INDUSTRIES	**2,368,815**	**2,866,164**	**497,349**	**21.0**	**549,017**	**11,217**	**-62,885**
Agriculture Forestry and Fishing	16,342	24,048	7,706	47.2	3,788	1,004	2,915
Mining	1,174	1,369	195	16.6	272	-455	378
Construction	72,566	130,110	57,544	79.3	16,819	18,630	22,095
Residential building	9,732	17,886	8,154	83.8	2,256	2,965	2,934
Nonresidential building	6,799	10,142	3,343	49.2	1,576	244	1,523
Highway and street	2,740	6,668	3,928	143.4	635	306	2,987
Electrical work	11,420	20,738	9,318	81.6	2,647	5,814	857
Manufacturing	464,595	436,126	-28,469	-6.1	107,679	-98,552	-37,595
Newspapers	14,275	13,668	-607	-4.3	3,308	-3,598	-317
Electronic computers	32,750	11,726	-21,024	-64.2	-25,160	-13,811	-14,803
Telephone and telegraph apparatus	13,281	11,874	-1,407	-10.6	-10,203	-1,145	-3,340
Semiconductors and related devices	11,332	10,867	-465	-4.1	-8,706	1,159	-4,251
Process control instruments	7,096	6,495	-601	-8.5	-5,451	-441	-1,805
Transportation and Public Utilities	118,111	141,089	22,978	19.5	27,374	1,784	-6,181
Wholesale trade	155,720	177,648	21,928	14.1	36,091	-11,749	-2,414
Electronic parts and equipment	8,238	14,524	6,286	76.3	1,909	1,625	2,752
Retail trade	486,312	571,275	84,963	17.5	112,712	-14,871	-12,878
Eating and drinking places	163,041	199,955	36,914	22.6	37,788	-142	-732
Finance, insurance, and real estate	193,179	224,065	30,886	16.0	44,773	-15,647	1,760
Security brokers and dealers	17,400	36,627	19,227	110.5	4,033	7,631	7,563
Real estate operators	7,737	9,401	1,664	21.5	1,793	-1,223	1,094
Services	860,816	1,160,434	299,618	34.8	199,510	131,073	-30,965
Help supply services	30,779	69,504	38,725	125.8	7,134	36,396	-4,804
Computer programming	5,281	18,299	13,018	246.5	1,224	10,404	1,390
Information retrieval	544	12,371	11,827	2174.1	126	2,540	9,161
Computer related services	4,538	21,900	17,362	382.6	1,052	13,026	3,284
Offices and clinics of medical doctors	42,697	52,202	9,505	22.3	9,896	3,979	-4,370

Notes: (1) NS= National growth effect. (2) IM= Industry mix effect. (3) RS= State share effect

favorable industry mix effect equal to 11,200 jobs or 2.2 percent of the net increase in employment due to the fact that the state had a mix of industries, particularly in the services sector, that experienced above average employment growth rates. We also have identified a set of state industries with large positive absolute employment changes between 1992 and 2000. Our goal is to identify those industrial sectors that were characterized by both a positive industry mix effect and a positive state share effect, since these are the industrial sectors that have experienced both above-average job growth nationally and a rising competitive advantage in our state.

Between 1992 and 2000, the national job growth rate effect by itself would have added 549,000 wage and salary jobs in the state, approximately 10 percent more jobs than were actually

Table 18:

Sources of Wage and Salary Employment Growth/Decline in Massachusetts, 1992-2000

SOURCE	NUMBER OF JOBS	PERCENT OF NET INCREASE
National growth rate	549,017	110.4
Industry mix of state	11,217	2.2
Changes in state job shares within industries	-62,885	-12.6
All	497,349	100.0

generated by the state's economy over this eight year period (Table 18). The mix of industries in the state in 1992 was modestly favorable, containing an above-average share of jobs in higher-growth industries that would have added 11,200 more jobs. The favorable national growth and industry mix effects, however, were offset by a loss of nearly 63,000 jobs due to declining state shares of national employment in a number of key industries, especially manufacturing, where declining shares of national jobs cost the state 37,600 wage and salary positions (Table 17).

The vast majority of the 131 industries included in our study registered strong growth in their employment levels over the 1992-2000 period (See Appendix A). Only 24 of the 131 industrial sectors included in our analysis experienced a decline in their employment levels. The manufacturing sector was the only major industrial sector of the Massachusetts economy that experienced a decline in its employment base from 1992 to 2000. The decline in wage and salary employment in the state's manufacturing sector was 28,469 or –6.1 percent. The loss of employment in the manufacturing sector was attributable to a combination of job losses nationally in this sector and a loss of employment due to a declining state share of employment in some manufacturing industries. Within the manufacturing sector, the one industry with the largest decline in employment that accounted for nearly half of the sector's decline in employment was manufacturing of electronic computers (SIC 3571). This high-technology industry experienced a decline of 21,024 jobs or 64 percent of its 1992 employment level. The employment decline in the electronic computer manufacturing sector was driven by both a decline in national employment in the industry and a decline in the state's employment share in this industry. The employment declines in the other manufacturing industries were not as large as that experienced by the manufacturing of the electronic computers industry. There were a few manufacturing industries that actually added employment during this time period. Industries in the state's manufacturing sector that experienced some growth were the following: periodicals, book publishing, miscellaneous publishing, pharmaceutical preparations, and sheet metal work.

One of the objectives of our shift-share analysis is to identify industrial sectors with employment growth over the 1992-2000 period that were characterized by a positive industrial mix and a positive change in the state share of national employment. From the analysis, we identified 43 industrial sectors with a positive industry mix and state share effect. Of the industrial sectors with a positive industry mix and regional share effect, the one that experienced the largest increase in employment was SIC 6211, security brokers and dealers. From 1992 to 2000, this industry added 19,227 new jobs, an increase of 110.5 percent. Massachusetts not only benefited from strong national job growth in this industry, but also from having an improving competitive advantage in this particular industry. Overall, the finance, insurance and real estate industries in Massachusetts experienced an increase of 30,886 jobs, or 16 percent. The largest contributor to the growth in employment in the finance, insurance and real

estate sector was the security brokers and dealers industry. Other industries in this sector, except real estate operators, experienced a declining share of national employment.

The private services sector was by far the industrial sector that added the most jobs in Massachusetts from 1992 to 2000.[3] Overall, employment in the services sector increased by 299,618 or 34.8 percent. Strong growth in this sector in Massachusetts was attributable to a strong national job growth rate and a favorable mix of industries that experienced above-average rates of growth at the national level. The state share effect in this major industrial sector, however, was negative, implying that the Massachusetts economy did not out-perform the national economy in this sector. Nevertheless, there were several industries within the broadly-defined services sector for which our shift-share analysis showed both a positive industry mix and state share effect, indicating a growing competitive advantage of the state. The service industries that experienced positive effects from both industry mix and state share and that registered substantive gains in employment were the following: SIC 7379 computer related services, SIC 7371 computer programming services, SIC 7375 information retrieval services, SIC 8051 skilled nursing care facilities, and SIC 8811 private households. Three of the above five industries were high-technology services. Unfortunately, these high-technology industries would experience a severe jobs downturn in the early years of the current decade.

Other industries that had a positive industry mix and state share effect between 1992 and 2000 included air courier services (SIC 4513), which added 10,030 jobs. In the wholesale trade sector, the industry with the largest gain in employment and a favorable industry mix effect and state share effect was the electronic parts and equipment industry (SIC 5065). This industry alone added about 6,300 jobs from 1992 to 2000 of which almost 44 percent were due to a favorable competitive advantage or increasing share in the state.

The construction industry was the only major industrial sector characterized by both a positive industry mix and state share effects. In the aggregate, this major industrial sector increased its wage and salary employment level between 1992 and 2000 by 57,444 jobs or 79.3 percent.[4] The individual industries that added the majority of jobs in the construction industry were the electrical work industries, followed by residential building construction, highway and street construction, and nonresidential building construction. The Big Dig projects contributed in an important means to growth in the highway construction industries. Each of the construction sub-sectors included in our shift-share analysis were characterized by a positive and significant state share effect.

MASSACHUSETTS EXPERIENCED ABOVE-AVERAGE JOB LOSSES.

Shift-share Analysis of Employment Changes in Massachusetts, 2001 I-II – 2004 I-II

We have divided the 2001-2006 time period into two separate units in order to better identify industry employment developments during the recession of 2001, the jobless recovery period from 2002 to early 2004, and the job growth recovery from 2004 to 2006. Findings of our shift-share analysis for the 2001-2004 period are presented for all private sector industries combined and 19 individual sectors. The results pertain to the first half of each calendar year.

Table 19:

Shift-Share Analysis of Changes in Massachusetts Wage and Salary Employment by Major Industrial Sector, 2001 I-II to 2004 I-II

INDUSTRY	2001	2004	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
TOTAL, ALL INDUSTRIES	**2,865,933**	**2,707,956**	**-157,977**	**-5.5**	**-55,115**	**16,921**	**-119,783**
Agriculture, forestry, fishing and hunting	5,867	6,193	326	5.6	-113	115	324
Mining	1,334	1,711	377	28.3	-26	-22	425
Utilities	11,858	10,199	-1,659	-14.0	-228	-460	-971
Construction	132,802	131,662	-1,140	-0.9	-2,554	3,744	-2,330
Manufacturing	401,342	313,627	-87,715	-21.9	-7,718	-52,775	-27,222
Wholesale trade	142,077	134,779	-7,298	-5.1	-2,732	-1,188	-3,377
Retail trade	355,251	349,897	-5,354	-1.5	-6,832	1,046	432
Transportation and warehousing	78,533	70,029	-8,504	-10.8	-1,510	-2,268	-4,725
Information	115,062	87,036	-28,026	-24.4	-2,213	-15,183	-10,630
Finance and insurance	182,715	172,720	-9,996	-5.5	-3,514	9,037	-15,519
Real estate, rental, leasing	44,345	43,837	-508	-1.1	-853	1,457	-1,112
Professional and technical services	249,217	221,912	-27,304	-11.0	-4,793	-3,735	-18,777
Management of companies and enterprises	73,330	64,196	-9,134	-12.5	-1,410	-77	-7,647
Administrative management and waste services	171,045	156,136	-14,909	-8.7	-3,289	414	-12,033
Educational services	111,056	117,460	6,404	5.8	-2,136	14,237	-5,698
Health care and social assistance services	406,981	429,186	22,205	5.5	-7,827	41,928	-11,896
Arts, entertainment, and recreation	38,960	43,336	4,376	11.2	-749	1,980	3,145
Accommodation and food services	232,951	237,215	4,264	1.8	-4,480	14,331	-5,587
Other services	111,209	116,825	5,616	5.0	-2,139	4,338	3,416

Notes: (1) NS= National growth effect; (2) IM= Industry mix effect; (3) RS= State share effect.

Between the first half of calendar years 2001 and 2004, Massachusetts lost nearly 158,000 wage and salary jobs, equivalent to 5.5 percent of the total number of private sector wage and salary jobs in the base period (Table 19). Nationally, wage and salary job losses were under 2 percent over the same three year period. The "national growth effect" by itself would have produced a job loss of only 55,114 between 2001 and 2004, which accounted for only 35 percent of the total job loss in the state (Table 20). The state had a favorable mix of industries in 2001 which would have added nearly 17,000 wage and salary jobs between 2001 and 2004 (Tables 20). Declining shares of national employment within most major industrial sectors played the key role in generating the large job losses in the state. Among the industrial sectors where declining shares contributed in an important way to the sizeable job losses in the state were the following:

- Manufacturing (-27,222)
- Professional and technical services (-18,777)
- Finance and insurance (-15,519)
- Administrative and waste management (-12,033)
- Information services (-10,630)

The poor performance of the state economy was heavily influenced by the above-average job losses of most major industries during the 2001-2004 period. Of the 19 major industrial sectors included in our shift-share analysis, fourteen reg-

istered a negative state share effect. For example, the finance and insurance sector, which performed quite well in the 1990s, experienced a decline in employment of just under 10,000 jobs or 5.5 percent. At the national level, finance and insurance industries experienced only a modest decline in their employment levels from 2001 to 2004. Massachusetts also should have benefited from having an above average share of jobs in this sector. The poor job creation performance of the industry at the state level was due to a declining share that was sufficient enough to offset the positive industry mix effect. The declining state share accounted for a job loss of 15,500 in the finance and insurance sector. Bank and insurance mergers and downsizing of local operations took a severe toll on jobs in this key industry between 2001 and 2004. A number of the firms in this sector had formed a key part of the state's export base.

Other industries that suffered severe employment losses from 2001 to 2004 and that were also adversely affected by a negative state share effect, were the manufacturing, transportation, information services, professional and technical services, management of companies, and wholesale trade industries. A comparison of the findings for the 2001-2004 period with the findings of the shift-share analysis for the 1992-2000 period reveals how the job performance of industries in the state drastically changed after 2000. The majority of the industrial sectors that added jobs during the 1990s labor market boom experienced substantial declines in employment after the end of the labor market boom in early 2001. Their poor job creation performance was not only affected by the national recession and jobless recovery but more seriously by a weakening of the competitive advantage of these industries in Massachusetts.

Only a few industrial sectors continued to add jobs from 2001 to 2004. The healthcare and social assistance industry added around 22,000 jobs, representing a 5 percent increase from its 2001 level. The state of Massachusetts clearly benefited from a strong rate of growth at the national level for this industry rather than from a positive share effect. Other industrial sectors that continued to add jobs during this time period were educational services, arts, entertainment, and recreation services, accommodation and food services, and "other services." Each of these Massachusetts industries benefited from strong national employment growth in the same industries while the arts/entertainment and "other services" industries benefited from rising state shares. Only a few of these industries were export-based.

Table 20:

Sources of Wage and Salary Employment Growth/Decline in Massachusetts, 2001 I-II to 2004 I-II

SOURCE	NUMBER OF JOBS	PERCENT OF NET INCREASE
National growth rate	-55,115	34.9
Industry mix of state	16,921	-10.7
Changes in state job shares within industries	-119,783	75.8
All	-157,977	-100.0

Shift-share Analysis of Employment Changes in Massachusetts, 2004 I-II to 2006 I-II

Key findings of our shift-share analysis of employment changes over the 2004-2006 period are presented in Table 21 and Table 22. The results pertain to the first two quarters of each calendar year. Massachusetts started to create jobs in early 2004 after three years of steady and steep declines at the aggregate level and in the majority of the major industrial sectors. Overall, private sector employment in Massachusetts increased by 43,573, or 1.6 percent, between 2004 and 2006. A strong national economy and a modestly favor-

Table 21:

Shift-share Analysis of Changes in Massachusetts Wage and Salary Employment by Major Industrial Sector, 2004 I-II to 2006 I-II

INDUSTRY	2004	2006	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
TOTAL, ALL INDUSTRIES	**2,707,956**	**2,751,529**	**43,573**	**1.6**	**112,576**	**1,419**	**-70,423**
Agriculture, forestry, fishing and hunting	6,193	6,116	-78	-1.3	257	-321	-14
Mining	1,711	1,658	-54	-3.1	71	228	-352
Utilities	10,199	9,625	-573	-5.6	424	-783	-214
Construction	131,662	136,116	4,454	3.4	5,474	9,591	-10,611
Manufacturing	313,627	300,164	-13,463	-4.3	13,038	-14,895	-11,607
Wholesale trade	134,779	135,772	993	0.7	5,603	314	-4,924
Retail trade	349,897	346,660	-3,237	-0.9	14,546	-6,561	-11,222
Transportation and warehousing	70,029	68,785	-1,244	-1.8	2,911	664	-4,819
Information	87,036	86,768	-268	-0.3	3,618	-5,580	1,694
Finance and insurance	172,720	178,256	5,537	3.2	7,180	-1,287	-357
Real estate, rental, leasing	43,837	43,929	92	0.2	1,822	42	-1,772
Professional and technical services	221,912	238,805	16,893	7.6	9,225	10,884	-3,217
Management of companies and enterprises	64,196	62,745	-1,451	-2.3	2,669	733	-4,853
Administrative management and waste services	156,136	162,934	6,798	4.4	6,491	4,189	-3,883
Educational services	117,460	121,159	3,699	3.1	4,883	2,425	-3,609
Health care and social assistance services	429,186	446,678	17,492	4.1	17,842	3,303	-3,653
Arts, entertainment, and recreation	43,336	43,118	-218	-0.5	1,802	-632	-1,387
Accommodation and food services	237,215	241,665	4,451	1.9	9,862	2,034	-7,445
Other services	116,825	120,574	3,749	3.2	4,857	-2,928	1,820

Notes: (1) NS= National growth effect; (2) IM= Industry mix effect; (3) RS= State share effect.

able positive industry mix were the forces underlying this employment increase (Table 21).

The national job growth effect by itself, however, would have added 112,576 wage and salary jobs in the private sector. The industry mix effect would have produced another 1,145 jobs in the state (Table 22). However, the "state share effect" reduced overall employment by more than 70,000, wiping out nearly 63 percent of the favorable national job growth effect. Declining job shares in 17 of the 19 major industrial sectors were responsible for the large, negative state share effect during this period of job growth. Massachusetts was continuing to lose its share of national jobs in most key industries. The loss of these jobs was encouraging working-age adults to leave Massachusetts to relocate to other states, mostly outside the New England region. This out-migration of working age adults and their families was creating a demand for retail trade and local services in other states, helping fuel job creation in many retail, local service, and construction industries in those areas.

As the state economy started to add jobs in 2004, several of the industries that experienced severe job losses from 2001 to 2004 produced an increase in their employment levels. Several industries that are important parts of the Massachusetts export base, such as finance and insurance, professional and technical services, and

educational services, registered increases in their employment base.[5] The second largest absolute increase in wage and salary employment after the healthcare and social services industries was registered by the professional and technical services industries, with an increase in wage and salary employment of 16,893, or 7.6 percent. This particular industry benefited from strong growth in national demand for such services, but experienced a modest decline in its share of national employment. Other industries that experienced a positive turn-around from the employment losses registered between 2001 and 2004 were construction and finance and insurance. Finance and insurance industries in Massachusetts added a total of 5,537 new jobs, a modest increase of 3.2 percent from 2004 to 2006. All of this increase was generated by a strong national job growth effect that offset a declining state share. Only two state industries outperformed the average national growth rate of employment in their sector. These two industries were information services and "other services." Most Massachusetts industries did not perform as well as their national counterparts during the recent economic expansion, and in nearly half of the cases they continued to lose jobs. Restoring the state's competitive edge in many industries will be key to future job growth in the Commonwealth.

Table 22:

Sources of Wage and Salary Employment Growth/Decline in Massachusetts, 2004 I-II to 2006 I-II

SOURCE	NUMBER OF JOBS	PERCENT OF NET INCREASE
National growth rate	112,576	258.3
Industry mix of state	1,419	3.3
Changes in state job shares within industries	-70,423	-161.6
All	43,573	100.0

Trends in High-Technology Employment in Massachusetts, 1990-2005

After experiencing large-scale job losses, especially in its traditional manufacturing base, in the early to mid 1970s, Massachusetts emerged as one of the bastions of high-technology industries, and employers in these industries helped drive the state economic boom during the late 1970s and the 1980s.[6] The high-tech sector also was one of the job and output drivers of growth in the Massachusetts economy from the early 1990s through the end of the decade. The emergence of high-technology industries that generate a high level of value added per worker in the Commonwealth's economy was attributable to the confluence of many forces, such as university labs spewing forth a flow of new innovations, a highly educated labor force, an inflow of venture capital investments from both private and public sources, and a supportive infrastructure in the state.[7]

However, since the end of the state's jobs boom in 2000, employment in high-technology industries in Massachusetts, along with the entire manufacturing sector, has been shrinking at an alarming pace due to outsourcing and downsizing of firms in the state.[8] The recent trend in services "offshoring" is projected by some analysts to accelerate in the future.[9] In recent years, the popular business press and the national/local media have generated a series of stories focused on job outsourcing in the high-technology sector from the U.S. to low wage countries, particularly to China and India.[10] These trends were not unique to Massachusetts, but also took place across the nation. However, due to the lack of any statistically reliable data on the true level of outsourcing, we

RESTORING THE STATE'S COMPETITIVE EDGE IS KEY TO FUTURE ECONOMIC GROWTH.

cannot say with certainty that the bulk of the job loss in the high-technology sector was due to outsourcing to other low-wage countries. Firm downsizings, plant closings, and relocations of production to other states also played a role. In addition, there has been intense competition among states, including California, Connecticut, Illinois, Minnesota, New Jersey, New York, North Carolina, Pennsylvania, and Virginia, to attract high-tech companies and industries to their states.[11] The state governments of New York and Pennsylvania have invested a large amount of research and training grants, tax breaks, and other subsidies to attract high-tech jobs to their state.[12]

Our analysis of employment trends in high-tech industries will show that, in recent years, Massachusetts has suffered job losses in the high-technology sector at a much higher rate than the entire nation. In this section, we will examine trends in wage and salary jobs in the high-tech industries of Massachusetts and compare the state's employment trends with those for the entire nation. In conducting our analysis, we have used the American Electronics Association's (AeA) definition of high-tech industries. The AeA has classified 49 individual NAICS-based industries as high-tech industries,[13] which can be combined into the 16 industry sectors listed in Table 23 below.[14] A more detailed categorization of high-tech industries along with their NAICS codes are displayed in Appendix B of this paper. The source of the employment data used in this analysis is that of the U.S. Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW), formerly known as the ES-202 Employment Survey.

MASSACHUSETTS LOST HIGH-TECH JOBS AT A MUCH HIGHER RATE.

Table 23:

Listing of 16 Major High-Tech Industries Used in the Jobs Analyses

INDUSTRY	
A	**Manufacturing**
1	Computers and Peripheral Equipment
2	Communications Equipment
3	Consumer Electronics
4	Electronic Components
5	Semiconductors
6	Defense Electronics
7	Measuring and Control Instruments
8	Electromedical Equipment
9	Photonics
B	**Communications Services**
10	Communication Services
C	**Software and Tech Services**
11	Software Publishers
12	Computer Systems Design & Related Services
13	Internet Services
14	Engineering Services
15	R&D and Testing Labs
16	Computer Training

Source: American Electronics Association (AeA), www.aeanet.org

In the QCEW survey, industries can be classified at increasing levels of detail up to a six-digit NAICS code. Data on the number of establishments, employees, aggregate wages, and mean annual wages are available for each industry by their NAICS codes on a quarterly and annual basis. However, one caveat on using these data is that there were six to nine small high-tech industries in Massachusetts for whom employment data were suppressed due to confidentiality reasons.[15] Some of these industries, particularly those manufacturing computer storage devices have a high share of their employment in Massachusetts, hence, our estimates of high-technology employ-

ment generated by our imputation procedure for missing industries may underestimate employment in this sector. However, the underlying trends in high-tech employment in our state will not change even if we adjust employment for these two industries. For example, as noted in Appendix B, employment in these two industries has declined by 4 percent between 2000 and 2005. However, employment in these two industries increased at a relatively high pace between 1990 and 2000. For further discussion on this issue, see Appendix B of this paper.

In Massachusetts, the number of wage and salary payroll jobs in high-tech industries was estimated to be more than 218,000 in 1990, and the level of employment in these same industries increased to 255,707 in 2000, when the state labor market was at its peak aggregate employment level. Over this 10-year period, wage and salary high-tech employment in Massachusetts increased by 37,701 or by 17.3 percent in relative terms. The Commonwealth's high-tech employment growth rate during this period, however, lagged behind the nation's growth rate in this sector by a fairly substantial margin (17% vs. 36%). Still, in 2000, high-tech employment as a share of total private sector wage and salary employment in Massachusetts was nearly two times higher than the national average. During that year, high-tech employment as a share of total private sector wage and salary employment in Massachusetts was nearly 9 percent, as opposed to only 5 percent for the entire U.S.

During the national and state recession of 2001, net job losses in the high-tech sector in Massachusetts started to occur, and this trend accelerated at an even more rapid pace in subsequent years. Slightly more than 58,000 wage and salary jobs in high-tech industries of Massachusetts were lost between 2000 and 2005 (Chart 6 and Table 24). During the same five-year period, the U.S. lost 1.01 million high-tech-related wage and salary jobs. Overall, Massachusetts lost 118,000 wage and salary jobs between 2000 and 2005; thus, high-tech job loss accounted for nearly half of all payroll job losses in the state's private sector. The high-tech wage and salary job loss rate in Massachusetts outpaced that of the nation

Chart 6:

Trends in High-Tech Industry Employment in Massachusetts, 1990-2005 (Annual Averages)

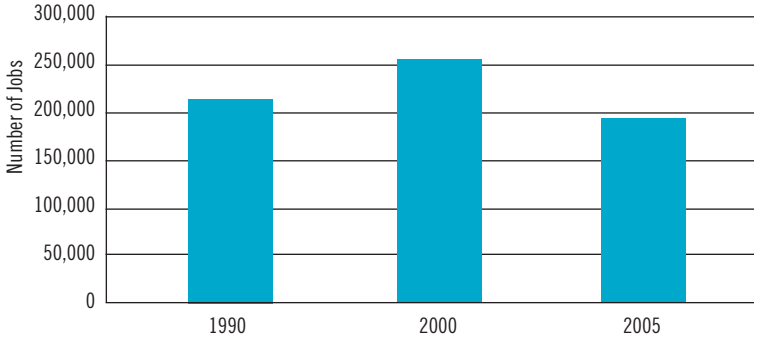


Table 24:

Trends in High-Tech Industry Payroll Employment in Massachusetts and the U.S., 1990, 2000, and 2005

	1990	2000	2005
Massachusetts	218,006	255,707	197,492
U.S.	4,496,910	6,134,353	5,119,079
Absolute Change	**1990-2000**	**2000-2005**	**1990-2005**
Massachusetts	37,701	-58,215	-20,514
U.S.	1,637,443	-1,015,274	622,169
Relative Change	**1990-2000**	**2000-2005**	**1990-2005**
Massachusetts	17.3	-22.8	-9.4
U.S.	36.4	-16.6	13.8
MA National Share	**4.8%**	**4.2%**	**3.9%**

Source: Quarterly Census of Employment and Wages (QCEW), public use files, U.S. Bureau of Labor Statistics, authors' tabulations.

Chart 7:

Comparisons of the Actual Number of High-Tech Jobs in Massachusetts in 2005 with the Hypothetical Number of Jobs that There Would Have Been in 2005 If the State Had Maintained Its 1990 Share of All National High-Tech Jobs

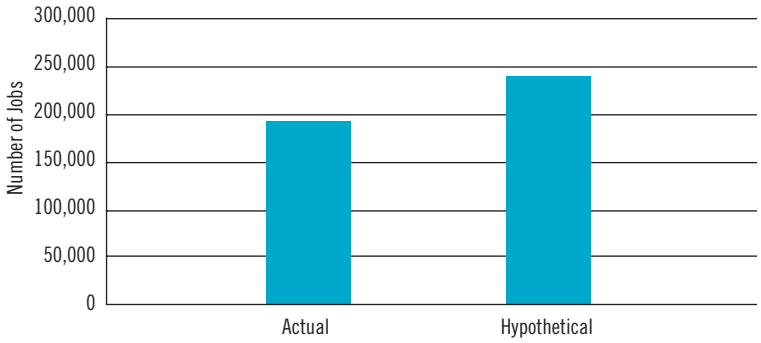
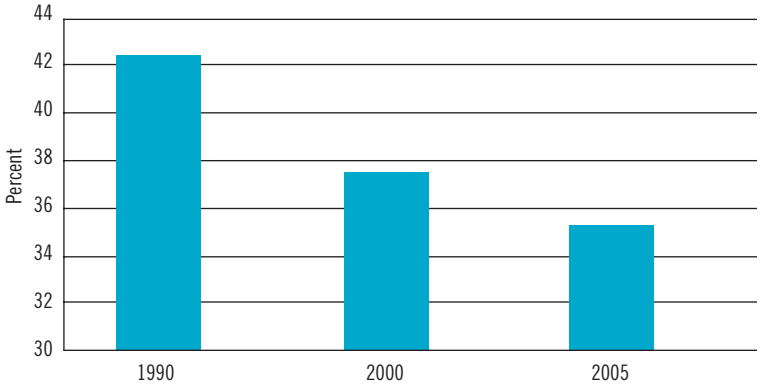


Chart 8:

Trends in the Share of High-Tech Sector Jobs in Massachusetts that were Estimated to Be Export Based, 1990-2005 (in percent)



by more than 7 percentage points (23% vs. 17%) between 2000 and 2005. As a result of this steeper rate of job decline, the national share of jobs in high-technology industries accounted for by Massachusetts firms declined from 4.8 percent in 1990 to 3.9 percent in 2005. This is not a trivial decline in our share of national jobs in this key sector given the economic importance of high-tech industries in the U.S. If the state had been able to maintain its national share of high-tech jobs over this 15-year period, there would have been another 51,000 high-tech jobs in our state in 2005, and the multiplier effect would have added an even larger number of jobs (another 70,000 jobs) in the state economy (Chart 7).[16]

Employment in the high-tech sector also is critical for the future growth of the Massachusetts economy since a high share of employment in this sector is "export based".[17] These export jobs in high-tech industries produce goods and services at a level over and above the demand within the state that are then sold to other states or countries. The high-tech industries in Massachusetts, thus, generate important output and employment multiplier effects on the economy as a whole via purchases from suppliers and the induced spending by workers, managers, and owners of these industries. Given the "export" oriented nature of many of the jobs in the high-tech industries, many other industries in the Massachusetts economy benefit from this sector. However, in recent years, particularly 2001 onwards, Massachusetts has been losing its competitive edge in this sector. In 2005, of the 197,492 high-tech jobs in Massachusetts, at least 69,000 or 35 percent were export-oriented jobs based on a location quotient analysis. This share, however, has declined from 42 percent in 1990 and 38 percent in 2000 to only 35 percent in 2005 (Chart 8). Clearly, the high-tech industry in Massachusetts has lost part of its vitality in recent years due to restructuring of the industry, downsizing, and outsourcing of some jobs to low wage countries like China and India.

Trends in Biotech Employment in Massachusetts, 1990 to 2005

Biotechnology industries have been viewed by some economic policymakers and industry analysts as critical to the future of the Massachusetts economy. The state is endowed with a highly supportive infrastructure such as research and development labs, excellent universities, a continuous flow of venture capital monies, and a well-educated workforce to support these industries. Recent research on biotechnology industries has shown the existence of positive spillovers from public research labs and university research to firms in the private sector.[18] The Biotech Organization, a national organization representing biotechnology industries in the U.S., defines biotechnology as "the use of cellular and biomolecular processes to solve problems or make useful products."[19] The biotech industries' products and services have wide applications in health care research and development, agricultural production, manufacturing, and the environmental field as well as many others. The biotech industry is evolving in the U.S. with a market capitalization of $311 billion, and a growing set of new products. More than 40 new biotech drugs and vaccines were approved in 2005.[20] This industry employed more than 1.3 million workers in the U.S in 2005.

In recent years, states in the U.S. have been competing to attract biotechnology industries by providing them with lucrative tax breaks and incentives. In Massachusetts, a comprehensive report prepared by the Massachusetts Biotechnology Council (MBC) titled "MassBiotech 2010" and published in 2002 highlighted both short-term and long-term objectives for achieving a leading global position of the state in this sector.[21] Since then, the Commonwealth has made a number of significant efforts to promote biotech industries in the state, and other states are following suit.[22] These competitor states are vying for these industries by providing various economic and tax incentives.

Table 25:

Listing of Biotechnology Industry, including NAICS Codes

NAICS	INDUSTRY
	I. Drugs & Pharmaceuticals
325411	Medicinal and botanical manufacturing
325412	Pharmaceutical preparation manufacturing
325413	In-vitro diagnostic substance manufacturing
325414	Other biological product manufacturing
	II. Medical Devices & Equipment
334510	Electromedical apparatus manufacturing
334516	Analytical laboratory instrument manufacturing
334517	Irradiation apparatus manufacturing
339111	Laboratory apparatus and furniture manufacturing
339112	Surgical and medical instrument manufacturing
339113	Surgical appliance and supplies manufacturing
339114	Dental equipment and supplies manufacturing
339115	Ophthalmic goods manufacturing
339116	Dental laboratories
541710	**III. Physical, Engineering, and Biological Research**
	IV. Testing & Medical Laboratories
541380	Testing laboratories
621511	Medical laboratories
621512	Diagnostic imaging centers

The biotech industry has a number of significant impacts on the economy both directly and indirectly through employment and income multipliers.[23] In 2004, according to research provided by Battelle Technology, among the biotech industries in Massachusetts, medical devices and equipment manufacturing had a total employment impact of 73,812 followed by research, testing, & medical laboratories (55,164), and drugs and pharmaceuticals manufacturing (45,081).[24]

In our employment analyses of the biotech

Table 26:

Trends in Wage and Salary Employment in the Biotech Industry in Massachusetts and the U.S., 1990-2005

MASSACHUSETTS	1990	2000	2005
Drugs & Pharmaceuticals	4,258	7,656	7,771
Medical Devices and Instrument	22,550	24,299	21,303
Physical, Engineering, and Biological Research	20,168	26,369	35,192
Testing & Medical Laboratories	6,468	6,719	10,808
Total	53,444	65,043	75,074
UNITED STATES			
Drugs & Pharmaceuticals	217,308	273,833	288,155
Medical Devices and Instrument	390,783	410,628	402,022
Physical, Engineering, and Biological Research	413252	448676	508529
Testing & Medical Laboratories	237,744	300,810	337,687
Total	1,259,087	1,433,947	1,536,393
ABSOLUTE CHANGE MASSACHUSETTS			
Drugs & Pharmaceuticals	3,398	115	3,513
Medical Devices and Instrument	1,749	-2,996	-1,247
Physical, Engineering, and Biological Research	6,201	8,823	15,024
Testing & Medical Laboratories	251	4,089	4,340
Total	11,599	10,031	21,630
ABSOLUTE CHANGE UNITED STATES			
Drugs & Pharmaceuticals	56,525	14,322	70,847
Medical Devices and Instrument	19,845	-8,606	11,239
Physical, Engineering, and Biological Research	35,424	59,853	95,277
Testing & Medical Laboratories	63,066	36,877	99,943
Total	174,860	102,446	277,306
RELATIVE CHANGE MASSACHUSETTS (IN PERCENT)			
Drugs & Pharmaceuticals	79.8%	1.5%	82.5%
Medical Devices and Instrument	7.8	-12.3	-5.5
Physical, Engineering, and Biological Research	30.7	33.5	74.5
Testing & Medical Laboratories	3.9	60.9	67.1
Total	21.7	15.4	40.5
RELATIVE CHANGE UNITED STATES (IN PERCENT)			
Drugs & Pharmaceuticals	26.0%	5.2%	32.6%
Medical Devices and Instrument	5.1	-2.1	2.9
Physical, Engineering, and Biological Research	8.6	13.3	23.1
Testing & Medical Laboratories	26.5	12.3	42.0
Total	13.9	7.1	22.0

Source: Quarterly Census of Employment and Earnings (QCEW), U.S. Bureau of Labor Statistics, tabulations by authors.

sector, we have included the following four major industries in the definition of the biotech industry.[25]

We have used payroll employment data from the state of Massachusetts and U.S. Bureau of Labor Statistics' Quarterly Census of Employment and Wages (QCEW) in our analysis to identify the annual levels of employment in biotechnology-related industries in Massachusetts, all other states, and the nation as a whole in recent years. Our analysis is based on the data for private sector establishments in the biotechnology sector.

Employment in Biotech Industries in Massachusetts and the U.S., 1990-2005

Biotechnology industries have been increasing their payroll employment levels in Massachusetts and the U.S. since the early 1990s (Table 26). In 2005, there were 75,074 payroll jobs in the biotechnology industries of the state. Of the four biotech industries in Massachusetts, employment in the physical, engineering, and biological research service industry accounted for the largest share of total biotech employment (47%), followed by medical devices and equipment manufacturing (28%), testing and medical laboratories (14%), and drugs and pharmaceuticals manufacturing (10%) (Table 26). A similar industrial pattern of payroll employment in biotech held true for the nation as well. However, Massachusetts' share of employment in the physical, engineering, and biological research service industry was well above the national share. For the entire nation, this particular industry's share of total biotech employment was only 33 percent compared to a 47 percent share in Massachusetts, implying the existence of a strong comparative advantage for the state in this industry.

Private sector, wage and salary employment in the biotech industry of Massachusetts has

increased from 53,444 in 1990 to 65,043 in 2000 and to 75,074 in 2005 (Table 26). The growth rate of biotech employment in Massachusetts during the 1990-2000 decade was 22 percent, which was substantially higher than the growth rate of the nation's biotech industry (14%) during the same time period (Chart 9). Growth rate in biotech jobs in Massachusetts over the 1990-2000 period varied fairly widely across the four biotech industries. Drugs and pharmaceuticals manufacturing in Massachusetts recorded the highest job gains in Massachusetts with a growth rate of nearly 80 percent in new wage and salary jobs over the 11-year period, substantially surpassing the nation's growth rate of jobs in this industry by a multiple of more than 3 (26%). The physical, engineering, and biological research service industry in Massachusetts also experienced an impressive job growth rate of 31 percent between 1990 and 2000, far surpassing the growth rate for the nation in this industry (31% vs. 9%). Medical devices and instrument manufacturing industries in Massachusetts posted a job gain of 8 percent during the 1990s whereas for the entire nation job growth in this biotechnology industry was only 5 percent. Among the four biotech industries, testing and medical laboratories was the slowest growth industry in Massachusetts. It experienced a growth rate of only 4 percent over the 1990-2000 period. Overall, the biotech sector in Massachusetts in the 1990s experienced robust gains in employment. As a consequence of the above average job growth rate in the state, Massachusetts increased its share of national biotechnology employment from 4.2 percent in 1990 to 4.5 percent in 2000. This sector was one of the few industrial sectors in the state to increase its share of national employment over the decade.

How has the biotech sector in Massachusetts

Chart 9:

Percent Growth in Biotech Industry Employment in Massachusetts and the U.S., 1990-2000, 2000-2005, and 1990-2005

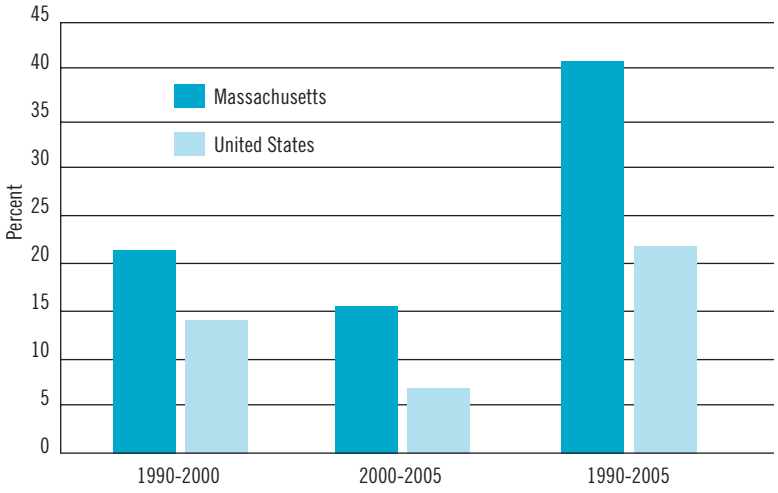


Chart 10:

Massachusetts' Share of National Wage and Salary Employment in Biotech Industries; 1990, 2000, and 2005 (in percent)

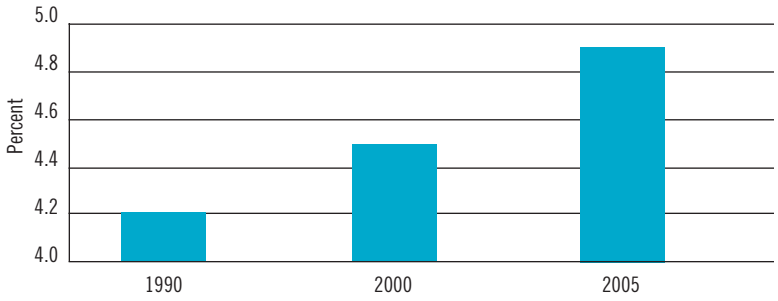
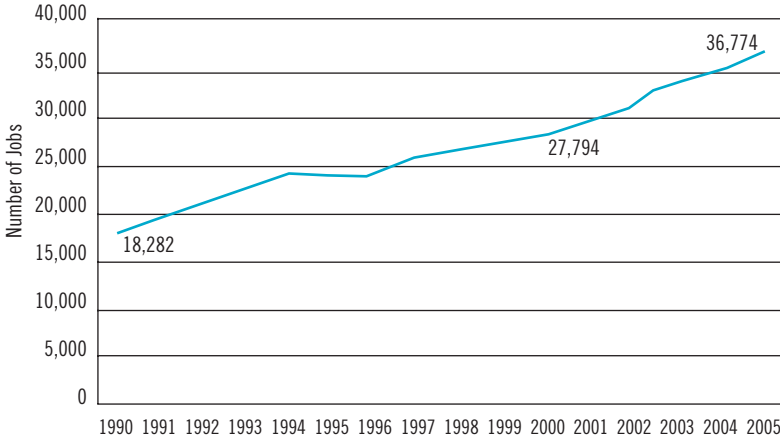


Chart 11:

Trends in Estimated Export-Oriented Wage and Salary Employment in Biotech Industries of Massachusetts, 1990-2005



performed in the first half of the current decade in generating new wage and salary jobs in the state? Between 2000 and 2005, Massachusetts' biotech industries added nearly 10,031 net new wage and salary jobs in the state, with payroll employment rising to 75,074. The growth rate of wage and salary jobs in the state exceeded the growth rate for the entire nation in the same biotechnology sector by 8 percentage points (15% vs. 7%) (Chart 9). Among the four biotech industries, wage and salary employment experienced growth in three industries ranging from 1.5 to 61 percent. The largest gain in jobs was in the testing and medical laboratories service industry (61%) followed by physical, engineering, and biological research service industry (33%), and pharmaceutical and drugs manufacturing (1.5%). In sharp contrast to the favorable developments in these three industries, medical device and instrument manufacturing industries in Massachusetts experienced a job decline of nearly 12 percent between 2000 and 2005. Along with the entire manufacturing sector in the Commonwealth, the medical instrument and supplies manufacturing industry suffered a substantial loss of jobs. For the entire nation, this industry experienced a smaller job loss rate, declining by only 2 percent over this same five-year period.

NEARLY HALF OF BIOTECH JOBS ARE EXPORT-ORIENTED.

Due to the above average job growth rate of biotechnology employment in Massachusetts over the 2000-2005 period, the state's share of national payroll employment in the biotechnology sector increased modestly from 4.5 percent in 2000 to 4.9 percent by 2005 (Chart 10). This sector was clearly a star performer in the state over the past five years, being one of the very few industrial sectors to experience a rise in its share of national employment when the state was encountering declines in its share in most other industries.

The biotech sector is also of economic importance to the state, given its role as an export-oriented industry. Nearly half of the jobs in the biotech industry of Massachusetts were estimated to be export-oriented (Chart 11). In 2005, we estimated that nearly one-half of the biotechnology sector jobs in Massachusetts produced goods and services for sale to other states or countries.[26] The estimated number of these export jobs in biotech industries has increased substantially over the years, rising from just over 18,258 in 1990 to 27,794 in 2000 and to nearly 37,000 in 2005. The multiplier effects of these biotechnology industries through inter-industry purchases of the firms themselves and the induced spending of workers and owners on locally produced goods and services helped fuel job expansion in other sectors of the state's economy.

Endnotes

1. For a more detailed description of the purposes and elements of the shift-share analysis technique, *See*: (i) John M. Levy, *Urban and Metropolitan Economics*, Virginia Polytechnic Institute and State University, 1985; (ii) Harvey Armstrong and Jim Taylor, *Regional Economics & Policy*, University of Lancaster, 1985; (iii) Walter Isard, *Methods of Regional Analysis: An Introduction to Regional Science*, The M.I.T. Press, Cambridge, 1960.

2. For a more detailed review of industry employment developments in Massachusetts during the 1980s and 1990s decades, see: Andrew Sum, Paul Harrington, Neeta Fogg, et. al., *The State of the American Dream in Massachusetts: 2002*, Massachusetts Institute for a New Commonwealth, Boston, 2002.

3. For a more detailed review of employment developments within the private services sector, *See*: Andrew Sum, Paul Harrington, Neeta Fogg, *The State of the American Dream in Massachusetts: 2002*, Massachusetts Institute for a New Commonwealth, Boston, 2002.

4. The construction sector in Massachusetts was extremely hard hit by the recession of 1989-1991. Payroll employment in this sector fell by nearly 50 percent between 1988 and 1992.

5. The private educational services industries include private colleges and universities which "export" a high share of their output due to tuition and fees from students coming into Massachusetts from other states and research grants from private firms outside of the state and the federal government.

6. For a review of industry employment developments in Massachusetts during the Miracle Decade of the 1980s and the role of high technology industries in transforming the state's economy, *See*: (i) Andrew Sum, Paul Harrington, and Neeta Fogg, N*ew England Labor Markets During the "Miracle Decade": Employment Growth, Structural Change, Labor Force Participation Patterns, and the Unemployment and Underemployment Problems of Resident Workers During the 1980s*, Center for Labor Market Studies, Northeastern University, Boston, 1991; (ii) David R. Lampe (Editor), *The Massachusetts Miracle*, The MIT Press, Cambridge, 1988; (iii) Susan Rosegrant and David Lampe, *Route 128: Lesson's from Boston's Hi-tech Community*, Basic Books, New York, 1992.

7. For a review of the definition of high technology industries in Massachusetts during the 1980s, *See*: Paul Harrington, Marilyn Boyle, and Andrew Sum, *High Technology Careers in Massachusetts*, Massachusetts Department of Employment and Training, Boston, 1986.

8. For an analysis of the level of hi-technology jobs displacement in Massachusetts due to outsourcing and corporate restructuring, *See*: Stephanie Luce and Kate Bronfenbrenner, *Capital Mobility and Job Loss in Massachusetts: A Look at Corporate Restructuring, Production Shifts, and Outsourcing*, Paper Presented at the Future of Work Conference, University of Massachusetts-Boston, April 2005.

9. Robert Atkinson and Howard Wial, *The Implications of Service Offshoring for Metropolitan Economies*, The Brookings Institution, Washington, D.C., 2007.

10. William Norman Grigg, "Exporting U.S. Jobs", *The New American*, September 22, 2003.

11. Robert Weisman, "Report Calls Mass. a New-jobs Laggard "Technology states" Offer Tough Rivalry", *Boston Globe*, December 18, 2006.

12. *See*: (i) Steve Lohr, "New York Bets on High-Tech Aid Update, *New York Times*, (October 28, 2006); (ii). Aug. 07, 2006 Press Release on the PA state government's home page. http://www.state.pa.us/papower/cwp/view.asp?Q=455262&A=11 "Rendell Administration Promotes High-Tech Job Creation with More than $2.5 Million For Workforce Training".

13. *Defining The High-Tech Industry: AeA's New NAICS-Based Industry Definition*, American Electronics Association (AeA), February 2003 (http://www.aeanet.org/Publications/idmk_naics.asp).

14. The AeA has included research and development in physical, engineering, and life sciences industry (NAICS 541710) in their hi-tech classifications. Most of these industries in Massachusetts are biotech or pharmaceutical industries. For this reason, we have excluded this industry from our analyses since we are conducting a separate analysis of job development in these industries.

15. There were no employment data available for nine hi-tech industries in 1990, seven industries in 2000, and six industries in 2005 in Massachusetts. Confidentiality rules of BLS with respect to publishing data for industries in which only a few firms exist are responsible for this lack of disclosure. In the U.S., the share of these missing industries' employment in total hi-tech employment was 1.7 percent in 1990, 1.8 percent in 2000, and only 1.8 percent in 2005. We assumed that the share of these missing industries' employment was the same in Massachusetts in those years. Thus, we imputed hi-tech employment for Massachusetts for those 10 missing industries in 1990, 2000 and 2005. These industries with missing data in Massachusetts in were optical instrument and lens mfg., computer storage device mfg., computer terminals device mfg., electronic capacitors mfg., electronic resistors mfg., electronic coils/transformers/other inductors, automatic environmental controls, totalizing fluid meter and counting devices, telecommunications resellers, satellite telecommunications, and web search portals.

16. The employment multiplier effect captures the jobs created by the purchases of goods and services from Massachusetts firm by the hi-tech industry and the induced spending on local goods and services by workers, managers, and owners of high-tech firms.

17. The number of high-tech jobs in Massachusetts over and above the required number of jobs in the same industry in the state to support local demand based is considered to be basic or "export" jobs. To estimate the number of jobs that were basic or "export" oriented, we used the following formula: *Basic Sector Employment* = ((Massachusetts employment in hi-tech industry / U.S. employment in high-tech industry) – (Total Massachusetts employment / Total U.S. employment)) * U.S. employment in high-tech industries. These estimates of export jobs in Massachusetts are likely to be conservative given brand differences in products produced. The high-tech industry consists of a heterogeneous set of firms producing these products and services. We may import some fraction of our demand for high-tech products and services from other states and export a larger fraction of our goods to other states and countries.

18. M. Kyle, "Does the Locale Affect R&D Activity? The Case of Pharmaceuticals," *Federal Reserve Bank of San Francisco Economic Letter*, Nov. 13, 2004.

19. Biotechnology Industry Organization, "BIO 2005-2006 Guide to Biotechnology," Washington, DC., www.bio.org.

20. "BIO 2005-2006 Guide to Biotechnology".

21. "MassBiotech 2010: Achieving Global Leadership in the Life-Sciences Economy", Massachusetts Biotechnology Council and The Boston Consulting Group, 2002.

22. Stephen Heuser, "The United States of Biotech: Fueled by Massachusetts' success, the Fight for a Share of the Nation's Life-sciences Industry Intensifies", *Boston Globe*, April 16, 2006.

23. *See*: (i). Ernst & Young, *The Contributions of the Biotechnology Industry to the U.S. Economy*, A Report Prepared for the Biotechnology Industry Organization, May 2000. (ii). *Biopharmaceutical Industry Contributions to State and the U.S. Economies*, Milken Institute, October 2004.

24. Battelle Technology Partnership Practice and SSTI, *Growing the Nation's Bioscience Sector: State Bioscience Initiatives 2006*, Prepared for Biotechnology Industry Organization (BIO), April 2006.

25. The Biotechnology Industry Organization (BIO) includes agricultural feedstock & chemicals, drugs & pharmaceuticals, medical equipment devices and equipment, and research/testing & medical laboratories in its definition of the Bioscience industry. Many other studies exclude agricultural feedstock and chemicals in their definition of the Biotech industry.

26. A location quotient technique was used to estimate export-based employment in the state's biotechnology industries using the QCEW payroll employment data for industries at the state and national level to make these estimates. The formulas underlying the location quotient approach were described in the preceding section on high technology employment developments.

IV. JOB VACANCIES IN MASSACHUSETTS

The availability of information on the numbers and characteristics of available job openings by industry and occupational area and across labor market areas of the state is crucial for the development of workforce policy and the operation of a wide array of workforce development programs. Efforts to place jobseekers in One Stop Career Centers, other labor exchange offices, and training/education institutions require information the numbers of available job openings, their occupational characteristics, hiring requirements, and geographic locations. The planning of job training programs should be based on knowledge of recent and anticipated employment developments by industry and occupation, the number of available job openings by industry and occupation, the geographic locations of the firms with these job openings, and the hiring requirements/wages of these job openings. Public policies to promote labor market efficiency by more effectively matching job vacancies with the number of unemployed persons are dependent on information on the industrial and occupational characteristics of both job vacancies and the unemployed.[1] More effective matching can reduce the durations of unemployment spells and enable employers to fill job vacancies more quickly, allowing an increase in the level of employment.

Until recently (2003), workforce development planners and labor market analysts in Massachusetts were handicapped in their efforts to rigorously identify labor shortages and surpluses due to an absence of comprehensive job vacancy data by industry and occupation. However, since the fall of 2002, the Massachusetts Department of Workforce Development through the operations of its Division of Unemployment Assistance has undertaken a statewide, semi-annual job vacancy survey that provides estimates of the number of job vacancies in the state as a whole, major industrial sectors, major occupational groups, and for seven geographic regions. These job vacancy data can be used together with data on employment developments by in industry to enable us to identify industries that meet selected job growth and job openings criteria. These industries can then serve as targets for future job development, job placement, and job training efforts. This section

THERE ARE NEARLY 75,000 JOB VACANCIES ACROSS THE STATE.

of the paper provides analysis of trends in the numbers and rates of job vacancies in Massachusetts from 2002 through 2005, identifies job vacancy levels and job vacancy rates by major industries in calendar year 2005, and compares the numbers of job vacancies with the estimated number of unemployed in these industries.

Data Sources on Job Vacancy and Unemployment Measures

The data on job vacancies by industry and unemployment levels by industry used in this paper are based on different state and national data sources. The sources of job vacancy data include: the Massachusetts job vacancy survey, which provides estimates of vacancy levels and rates by major industry and occupations in the state and seven geographic regions. A national job vacancy survey is conducted monthly by the U.S. Bureau of Labor Statistics. The National Job Openings and Labor Turnover Survey (JOLTS) provides estimates of job vacancies and vacancy rates by major industrial sectors for the country and its four geographic

Chart 12:

The Estimated Number of Job Vacancies in Massachusetts, 4th Quarter of 2002 to 4th Quarter of 2005

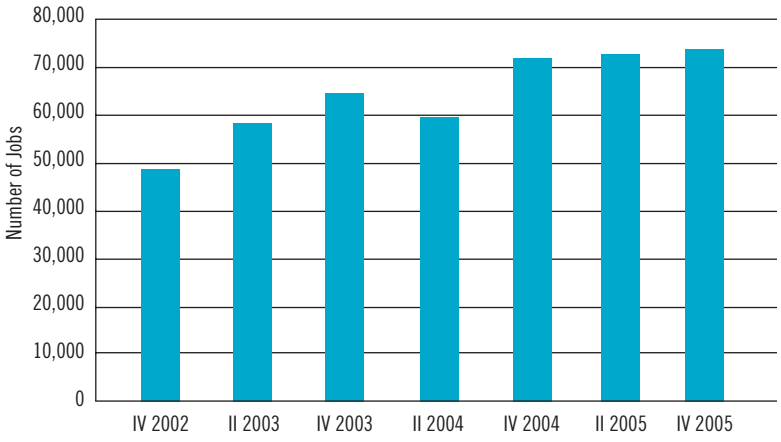
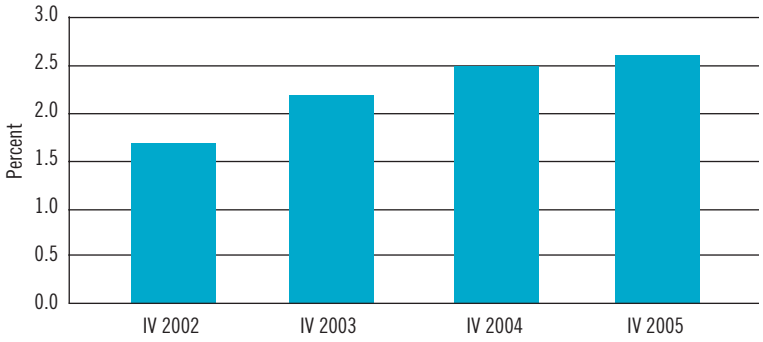


Chart 13:

Estimate of Job Vacancy Rates in Massachusetts, 4th Quarter 2002 to 4th Quarter 2005 (in percent)



regions. Data from these two surveys will be used to compare state job vacancy rates in major industrial sectors with same estimates for the nation in calendar year 2005.

Unemployment data by major industrial sector of the state were obtained from an analysis of monthly Current Population Survey (CPS) data for 2005. Comparable data from the CPS survey are available for each of the other forty nine states and the District of Columbia. The existence of unemployment data by major industry allows us to generate annual average estimates of unemployment for major industrial sector. Comparisons of the unemployment data and job vacancy data by major industrial sector are undertaken in order to identify the extent of labor surpluses and shortages in major industrial sectors of the state in 2005.

Trends in the Number of Job Vacancies in Massachusetts from 2002 IV to 2005 IV

Every year since the fall of 2002, the Massachusetts Division of Unemployment Assistance has conducted a semiannual job vacancy survey across the state. The surveys cover both private sector firms and government agencies at the local, state, and federal level. Findings of the surveys are used to generate estimates of the number of existing job openings for the state and its seven geographic regions by major industry and major occupational groups. These job vacancy estimates represent a measure of unfilled labor demand. They represent job openings for which the firm is making active efforts to fill with applicants from outside firm.

Recently, the Massachusetts Division of Unemployment Assistance provided estimates of job vacancy rates for the state for the fourth quarter of 2005.[2] In the fourth quarter of 2005, there were approximately 74,304 job vacancies across the state, this number of vacancies was approximately 1,500 higher than the number of vacancies recorded in the previous survey in the second quarter of 2005 and also the highest number of vacancies registered since the Division of Unemployment Assistance first implemented the survey in the fourth quarter of 2002 (Chart 12).[3]

Estimates of the total number of job vacancies in Massachusetts from the fourth quarter of calendar year 2002 through the fourth quarter of calendar year 2005 are displayed in Chart 12. The

first job vacancy survey in the state in the fourth quarter of 2002 yielded somewhat less than 50,000 job openings across the state, representing a job vacancy rate of only 1.7 percent (Chart 13). Over the next three years the number of job vacancies gradually increased, rising to just under 65,000 in the fourth quarter of 2003, to 71,900 in the fourth quarter of 2004 and to nearly 75,000 in the fourth quarter of 2005.[4] The overall job vacancy rate of the state rose from 1.7 percent in the fourth quarter of 2002 to 2.6 percent in the fourth quarter of 2005, indicating a higher level of difficulty faced by firms in filling their existing job vacancies in recent years as job growth was renewed.

With the available job vacancy data for the second and fourth quarters of 2005, we have estimated the quarterly average number of job vacancies and job vacancy rates for calendar year 2005 by major industrial sector (Table 27). The job vacancy estimates are classified by industry with the use of the North American Industrial Classification System (NAICS). On average, there were 73,559 job vacancies in Massachusetts during 2005. The number of job vacancies in 2005 varied quite considerably across major industrial sectors of the state. The industrial sector with the largest number of job vacancies during calendar year 2005 was Healthcare with 15,989 vacancies representing 21.7 percent of the total number of vacancies in the state. The retail trade sector accounted for the second largest number of job vacancies with an estimated number of 11,035 job vacancies followed by the Professional and technical services sector with 7,017 job vacancies during the same year. At the bottom of the distribution were the mining sector with only 40 job openings, the utilities sector with only 56 job vacancies, and real estate with 845 job vacancies.

Annual estimates of job vacancy rates in 17 major industrial sectors of the state in 2005 are displayed in Chart 14. Job vacancy rates for industries are calculated by dividing the number of job vacancies in a specified industrial sector by the estimated number of wage and salary workers that same sector during the same time period.

The overall job vacancy rate in Massachusetts during 2005 was 2.6 percent, the highest it has been over the last four years. The vacancy rates varied considerably across industrial sectors during 2005. These job vacancy rates ranged from lows of 0.4 percent in the utilities industries, 1.0 percent in agricultural services, and 1.3 percent in educational services industries to highs of 3.8 percent in healthcare and 3.7 percent in profes-

Table 27:

Job Vacancy Levels by Major Industry in Massachusetts, 2005

INDUSTRY	II Q 2005	IV Q 2005	AVERAGE 2005
Total	72,813	74,305	73,559
Healthcare	16,203	15,774	15,989
Retail trade	8,251	13,819	11,035
Professional and technical services	6,160	7,873	7,017
Accommodation and Food Services	8,164	5,477	6,821
Manufacturing	5,270	4,539	4,905
Educational services	5,471	4,104	4,788
Finance & Insurance	4,001	3,420	3,711
Administrative and support services	3,686	2,476	3,081
Construction	2,948	2,184	2,566
Information	2,620	1,997	2,309
Transportation and warehousing	1,620	2,631	2,126
Public administration	1,183	2,623	1,903
Wholesale trade	1,918	1,825	1,872
Other services	1,610	1,734	1,672
Management	1,423	1,438	1,431
Arts, entertainment, and recreation	1,576	1,072	1,324
Real Estate	473	1,217	845
Agriculture	128	*	128
Utilities	68	44	56
Mining	40	*	40

Data Sources: Massachusetts Job Vacancy Survey, 2nd and 4th quarters 2005.

sional and technical services industries. The latter two industries had generated the bulk of new jobs in the state the past two years. Other industrial sectors with relatively high job vacancy rates were retail trade (3.3%) and administrative and support services industries (3.2%). A high fraction of the job vacancies in the state's retail trade industries were part-time during calendar year 2005. 34 percent of all job vacancies were part-time in 2005, but in the retail trade industries 62 percent of the existing job openings were part-time. Part-time employment is desirable for many teens and students enrolled full-time in high school and college. The depressed employment rates of teens in the state would be boosted by more effective matching of job vacancies with teens, students, and older adults. A relatively high share of the job vacancies in the healthcare sector (41%) also was part-time; however the vast majority (97%) of the jobs in the healthcare industries were permanent positions. In contrast, 41 percent of the openings in retail trade were categorized as temporary or seasonal, reflecting the impact of the holiday season and seasonal industries in this particular sector.

Comparisons of Job Vacancy Rates in Massachusetts with those of the U.S. by Major Industrial Sector, 2005

As noted earlier, the U.S. Bureau of Labor Statistics collects job vacancy data for the nation and the four geographic regions. The job vacancy data can also be used to estimate job vacancy rates for the nonfarm economy and major industries. Comparisons of both overall job vacancy rates and those by major industries in the U.S. and Massachusetts during calendar year 2005 are displayed in Table 28.

The overall job vacancy rate in Massachusetts during calendar year 2005 was 2.6 percent, which

Chart 14:

Estimated Job Vacancy Rates in Massachusetts by Major Industrial Sector, 2005 Annual Average (in percent)

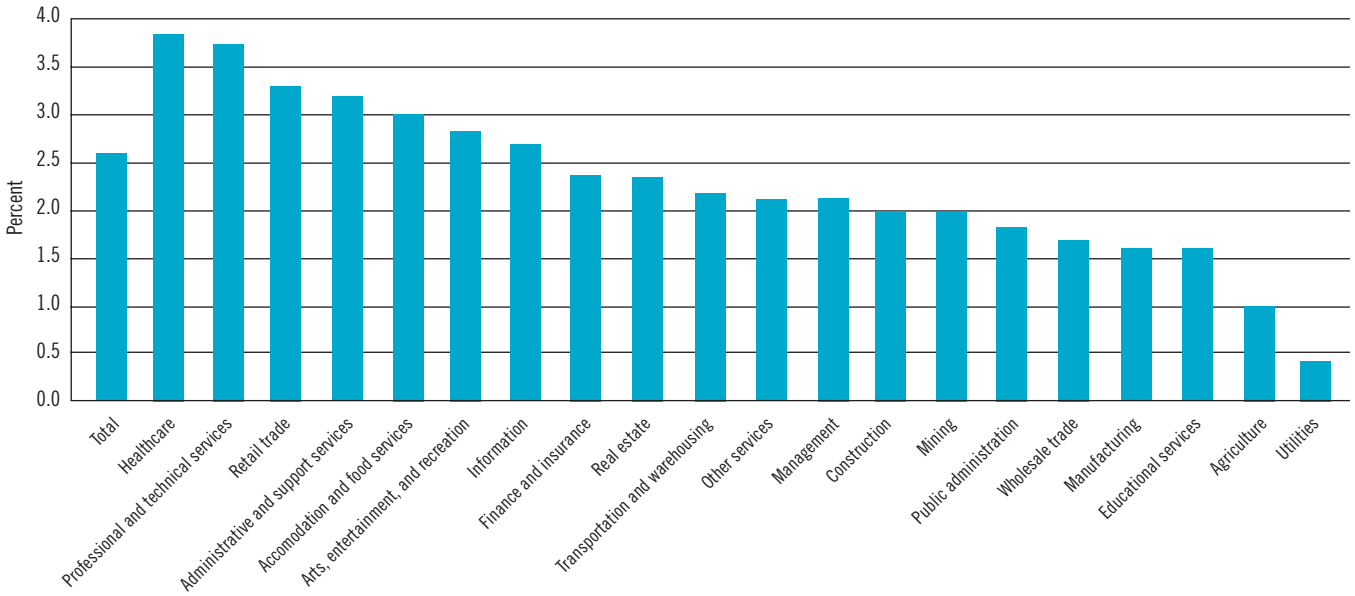


Table 28:

Comparisons of Job Vacancy rates in Massachusetts and the U.S., 2005

INDUSTRY	MASSACHUSETTS 2005	U.S. 2005	RATIO MASSACHUSETTS / US
Total	2.6	2.7	0.96
Healthcare	3.8	3.6	1.04
Professional and technical services	3.7	3.8	0.96
Retail trade	3.3	2.5	1.32
Accommodation and Food Services	3.0	3.6	0.82
Arts, entertainment, and recreation	2.8	3.1	0.89
Information	2.7	2.8	0.95
Finance & Insurance	2.4	3.1	0.76
Real Estate	2.4	2.2	1.07
Transportation and warehousing	2.2	2.2	1.00
Other services	2.1	2.3	0.91
Construction	2.0	1.8	1.11
Public administration	1.8	1.8	0.97
Wholesale trade	1.7	2.1	0.79
Manufacturing	1.6	1.9	0.84
Educational services	1.6	2.1	0.74

was slightly below the 2.7 percent rate for the U.S. The industrial patterns of job vacancy rates in both areas were quite similar during calendar year 2005 with a few exceptions (Table 28). Above-average job vacancy rates were registered by the healthcare, professional/technical services, and accommodation and food services industries in both Massachusetts and the U.S. In both areas the healthcare and professional/technical services had the highest job vacancy rates. The healthcare industry had a vacancy rate of 3.8 percent in Massachusetts vs. 3.6 percent in the U.S. The professional/technical services industries had a vacancy rate of 3.7 percent in Massachusetts vs. a 3.8 percent in the U.S. Job vacancy rates were below average in both areas in transportation and warehousing, other services, construction, wholesale trade, manufacturing, and educational services during calendar year 2005. Job vacancy rates in wholesale trade, manufacturing, and educational services industries in Massachusetts were below average for the state and below those of their counterparts in the U.S. during 2005.

Identifying Labor Shortages and Surpluses within Major Industrial Sectors of Massachusetts

Job vacancy data can also be used together with unemployment data to identify the degree of labor shortages or surpluses in a specific set of industries. By comparing estimates of the number of job vacancies in major industrial sectors of the state in 2005 with the number of unemployed persons, we can identify the relative magnitude of labor shortages/surpluses in these major industrial sectors of the state.

Job vacancy data from the second and fourth quarters of 2005 for Massachusetts were averaged to provide an estimate of the average annual number of job vacancies in 2005 in 17 major indus-

Table 29:

Ratios of Unemployment to Vacancy Levels by Major Industries in Massachusetts in 2005

	JOB VACANCIES 2005			ANNUAL AVG. UNEMPLOYMENT	
INDUSTRY	2ND Q	4TH Q	ANNUAL AVERAGE	2005	RATIO U/V
Total	72,813	74,305	73,559	156,206	2.12
Healthcare	16,203	15,774	15,989	12,846	0.80
Finance & Insurance	4,001	3,420	3,711	4,539	1.22
Real Estate	473	1,217	845	1,116	1.32
Professional and technical services	6,160	7,873	7,017	9,328	1.33
Information	2,620	1,997	2,309	3,654	1.58
Retail trade	8,251	13,819	11,035	19,597	1.78
Accommodation and Food Services	8,164	5,477	6,821	12,568	1.84
Public administration	1,183	2,623	1,903	3,538	1.86
Arts, entertainment, and recreation	1,576	1,072	1,324	2,604	1.97
Educational services	5,471	4,104	4,788	10,607	2.22
Wholesale trade	1,918	1,825	1,872	4,613	2.46
Transportation and warehousing	1,620	2,631	2,126	7,168	3.37
Management, Administrative and support services	5,109	3,914	4,512	16,234	3.60
Other services	1,610	1,734	1,672	6,082	3.64
Manufacturing	5,270	4,539	4,905	18,056	3.68
Construction	2,948	2,184	2,566	19,246	7.50
Utilities	68	44	56	697	12.45

Data Sources: Massachusetts Job Vacancy Survey, 2nd and 4th quarter 2005; Current Population Survey 2005.

trial sectors. The twelve monthly CPS public use files for Massachusetts for 2005 were used to derive estimates of the number of unemployed persons in each of these industrial sectors. During calendar year 2005, there were approximately 2.1 unemployed persons for every job vacancy in the state (Table 29). These unemployment-to-job-vacancy ratios varied quite considerably across the 17 major industrial sectors included in the analysis. The ratios ranged from lows of 0.80 in healthcare industries and 1.2 to 1.3 in finance and insurance, real estate, and professional/technical services industries to 3.6 to 3.7 in management/administrative and support services, other services, and manufacturing and 7.5 and to highs of 12.4 in construction and utilities, respectively. The only sector that registered more job openings than unemployed persons was healthcare. This sector had nearly 16,000 job openings on average during 2005, accounting for one of every five job openings in the state. Other industries in the state were characterized by a near balance between the numbers of unemployed and job vacancies were finance and insurance, real estate, and professional and technical services. Job placement and training strategies for these sectors need to be implemented.

HEALTH CARE AND PROFESSIONAL/ TECHNICAL SERVICES HAD THE HIGHEST JOB VACANCY RATES.

The remaining industries were characterized by large labor surpluses, with high ratios of unemployed persons per job vacancy being experienced in some industries. These industries included utilities, construction, manufacturing, transportation, and management/administrative and support services. A number of the unemployed in these industrial sectors may be in need of retraining to improve their immediate employment prospects.

Endnotes

1. For a review of the uses of job vacancy data in identifying occupational shortages at the state and local level and analyzing labor markets at the metropolitan level, *See*: (i) Andrew Sum and Paul E. Harrington, *Job Vacancy Data and the Measurement of Occupational Shortages and Surpluses at the State and Local Level*, Center for Labor Market Studies, Northeastern University, Boston, 1983; (ii) Harry J. Holzer, *Unemployment, Vacancies, and Local Labor Markets*, W.E. Upjohn Institute for Employment Research, Kalamazoo, 1989.
2. For information on the design of the job vacancy survey and key findings of the 2005 surveys see: Massachusetts Department of Workforce Development, Massachusetts job Vacancy Survey 2nd and 4th Quarter 2005, Boston, 2006.
3. The first two rounds of the state job vacancy survey excluded the government from the universe of coverage. Government agencies have been surveyed since the fall of 2003.
4. Part of the rise in the number of job vacancies between the fourth quarters of 2002 and 2003 was attributable to expansion of coverage to the public sector.

V. CONFLICTING FINDINGS FROM THE PAYROLL AND HOUSEHOLD SURVEYS

Data on current employment developments in Massachusetts and all other states across the nation are generated by two monthly surveys/ statistical programs. The first of these is the monthly survey of economic establishments used to generate estimates of nonfarm wage and salary employment in the state. This monthly survey is conducted by the Massachusetts Division of Unemployment Assistance. This monthly survey of a sample of private sector firms and government agencies, also known as the Current Employment Statistics survey (CES), provides estimates of the number of wage and salary jobs on the formal payrolls of private sector firms and government agencies that are located in Massachusetts. The CES Survey is the source of all of the wage and salary employment data analyzed in the preceding sections of this paper. A second source of monthly data on employment as well as unemployment developments in Massachusetts is that provided by the Local Area Unemployment Statistics program, typically referred to by its acronym (LAUS). The Local Area Unemployment Statistics program provides monthly and annual average estimates of the number of employed and unemployed residents (16 and older) in the state. The LAUS employment estimates are annually benchmarked to the findings of the monthly CPS household surveys in Massachusetts. The LAUS system, which relies on data inputs from the CES payroll survey, the CPS household survey, and the unemployment insurance system, provides estimates of the monthly resident labor force, employed, and unemployed populations in Massachusetts and a variety of substate areas.[1]

THE DIFFERENCE BETWEEN THE TWO SURVEYS WAS EXTRAORDINARILY LARGE.

The employment concepts and measures underlying these two alternative methodologies do differ somewhat as will be noted in more detail below. The CES employment measure is a count of nonfarm wage and salary jobs in the state based on the locations of the firms/government agencies not on the residences of the workers in those firms. The LAUS employment estimates are a count of employed residents (16 and older) regardless of the locations of their jobs, and the LAUS estimates cover a more comprehensive array of jobs than the CES payroll survey. Nationally, the two surveys' estimates of employment change typically though not always move in the same direction and are frequently of similar magnitude, but they have differed in our state by a considerable degree at various points in time over the past two decades, including the recessionary period of 1989-1992 and the labor market boom from 1992 to 2000.[2] To determine whether the CES and LAUS surveys have yielded similar estimates of employment change in Massachusetts over the past five years, we compared their estimates of aggregate employment change over the 2001 I - 2004 I period and the 2004 I - 2006 III/ IV period.[3] The first time period covers the three years of nearly continuous payroll job losses in the state while the latter period begins with the renewal of wage and salary job growth in the state in the first quarter of 2004 through the end of 2006. From the first quarter of calendar year 2001 through the first quarter of 2004, wage and salary employment in the state declined by nearly 194,000, or 6 percent, according to the findings

of the CES payroll survey (Table 30). While the LAUS survey also indicates that employment of state residents declined over this three-year period, the estimated magnitude of the decline in resident employment from the LAUS survey was considerably smaller (-85,000). The difference between these two surveys' estimates of state employment decline over this three year period was an extraordinarily large 109,000 (Table 30). Clearly, from the end of the state and national labor market boom in early 2001 through the first quarter of 2004, the two surveys did not produce similar findings of employment change. Instead, they have generated substantially different estimates of employment decline in the state, with the LAUS survey suggesting a much more modest decline in job opportunities for state residents (-2.5% vs. -5.7%).

Since the first quarter of 2004, both surveys have shown gains in employment in the state though the magnitude of the estimated gains have been larger according to the CES survey. The CES survey shows seasonally adjusted wage and salary employment up by 65,000 jobs from the first quarter of 2004 through the last six months of 2006 while resident employment in the LAUS survey is up by only 38,000. The gap in employment growth estimates between the two surveys over this time period was 27,000 (Table 31). Over the 5-year period (2001 I -2006 III-IV), the gap between the employment changes measured by the two surveys is 82,000, a very large difference, equivalent to nearly 3 percent of state employment.

The large gaps between the employment change estimates from the CES and LAUS surveys for Massachusetts for the 2001-2004 period and from early 2004 to the present time need to be explained to provide a better understanding of recent labor market conditions in Massachusetts and to guide workforce development policymaking and program planning. As noted in our earlier discussion on the design features of the two employment surveys, there are a number of important conceptual differences between the employment measures of the monthly CES payroll survey and those from the LAUS system, the latter of which are based on counts of the resident employed (Table 32). In the remainder of this section, we will attempt to explain the sources of the large gap between these two surveys' estimates of employment decline in Massachusetts over the 2001-2004 period and the magnitude of the increase in employment since the first quarter of 2004.

There are a number of important differences in the employment concepts and measures underlying the two surveys. First, the CES payroll employment survey provides estimates of the number of

Table 30:

Estimated Changes in the Number of Wage and Salary Jobs and Employed Residents (16+) in Massachusetts from 2001 I to 2004 I, CES and LAUS Surveys (Seasonally Adjusted, in 1000s)

	1ST Q 2001	1ST Q 2004	ABSOLUTE CHANGE
CES	3,380	3,186	-194
LAUS	3,288	3,203	-85
CES - LAUS			-109

Source: Massachusetts Division of Unemployment Assistance, website.

Table 31:

Estimated Changes in the Number of Wage and Salary Jobs and Employed Residents (16+) in Massachusetts From the First Quarter of 2004 Through the Last Six Months of 2006 (Seasonally Adjusted, in 1000s)

EMPLOYMENT SOURCE	1ST Q 2004	LAST 6 MONTHS 2006	ABSOLUTE CHANGE
CES	3,186	3,251	+65
LAUS	3,203	3,241	+38
CES - LAUS			+27

Table 32:

Differences Between the CES and LAUS Surveys in their Coverage of Different Types of Employment

EMPLOYMENT CATEGORY	CES SURVEY	LAUS/CPS SURVEY
Multiple job holders in state	Will count each job held by the multiple job holder (if wage and salary jobs)	Each employed person only counts once
In-commuters into the state from other states	Will count if wage and salary jobs	Do not count
Self-employed	Are not covered by survey	Do count as employed
Independent contractors	Are not covered by survey	Do count as employed
Off-the-books workers	Are not covered by survey	Will count if such jobs are reported to CPS interviewers
Private household workers	Typically not covered by survey	Will be counted as employed

wage and salary jobs on the payrolls of firms in the private, nonfarm sector and in government agencies at all levels (federal, state, and local). The payroll survey's employment estimates are a count of jobs rather than employed people. A resident of Massachusetts who holds two wage and salary jobs in the state would be counted twice in the payroll survey but only once in the LAUS employment estimates for our state. A decline in multiple jobholding during the labor market downturn from early 2001 to early 2004 would reduce the CES employment count but not the LAUS employment estimate. Following the end of the labor market boom in Massachusetts in 2000, the multiple jobholding rate in the state is estimated to have declined from 5.9 percent in 2000 to 5.0 percent in 2001. A decline of this magnitude in the multiple jobholding rate would have generated a reduction of more than 25,000 multiple jobholders in the state. If all of the lost jobs of these multiple jobholders were wage and salary positions, then this development by itself would have reduced payroll employment in Massachusetts by 25,000 between 2000 and 2001 but left LAUS employment levels unchanged.[71] However, the multiple jobholding rate in Massachusetts increased to 5.5 percent by 2004, and is up slightly to 5.7 percent in 2006 (Chart 15). Changes in multiple jobholding between 2001 and 2004 would have reduced the gap between the CES/LAUS estimates of employment change. Thus, the change in multiple jobholding between 2000 and 2004 can only account for a small share of the gap between the CES and LAUS estimates of employment changes over this period. The small increase in the multiple jobholding rate between 2004 and 2006 could be contributing to the larger gain in employment registered by the CES survey since the first quarter of 2004.

Second, the CES payroll survey counts all wage and salary jobs on the formal payrolls of Massachusetts' firms regardless of the geographic locations of the residences of the employees. A worker who commutes into Massachusetts from Rhode Island or New Hampshire for his wage and salary job would add to the CES payroll employment total in Massachusetts but would not affect the LAUS employment count, which is based on resident employment only. At the time of the 2000 Census, approximately 166,000 persons from the other five New England states and New York commuted into Massachusetts for their jobs.[5] In 2004, according to estimates from the American Community Surveys for the New England states, the number of in-commuters into Massachusetts from these same states during calendar year 2004 was 163,300. This represents a reduction of only 2,700 in-commuters. If all of

them had held wage and salary jobs, the CES payroll survey would have been characterized by a 2,700 job loss while the LAUS employment estimate would have been unchanged. This factor by itself cannot account for any substantive portion of the gap between the CES and LAUS survey estimates of employment decline between 2001 and 2004.

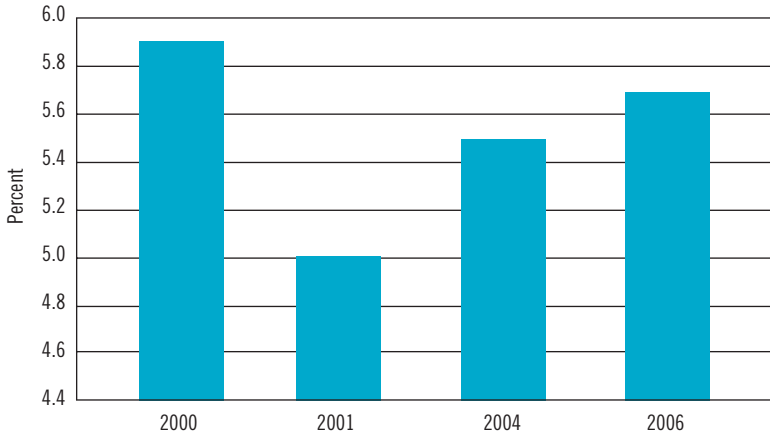
Third, as noted earlier, the CPS employment concepts underlying the LAUS survey are more comprehensive in coverage than those underlying the CES payroll employment estimates. The CPS estimates include the self-employed, independent contractors, farm workers, private household workers, unpaid family workers, and persons working off the books, including both native born workers and immigrants. The CPS surveys for Massachusetts for 2000 yielded a self-employment count of 219,700 vs. an estimate of 243,300 self-employed persons in 2004, a gain of 23,600 (Chart 16). Many of the former jobs of these newly self-employed would have been categorized as wage and salary jobs and would have been covered by the monthly CES payroll survey while their new positions would have been classified as self-employment in the CPS household survey and excluded from the CES count.[6]

For some of these individuals, their new self-employment positions were the result of a voluntary choice while for others the move to self-employment was the consequence of an involuntary job loss that placed economic pressures on them to secure new employment in the absence of acceptable job offers from employers in the state. Three real world examples of individuals that moved into self-employment are:

- A high technology engineer who was laid off from his job and went on to establish his own landscaping firm;
- A former software developer/computer programmer who left his firm to create his own company.
- A former bricklayer who left his job as an employee of a residential construction firm to form his own masonry business.

Chart 15:

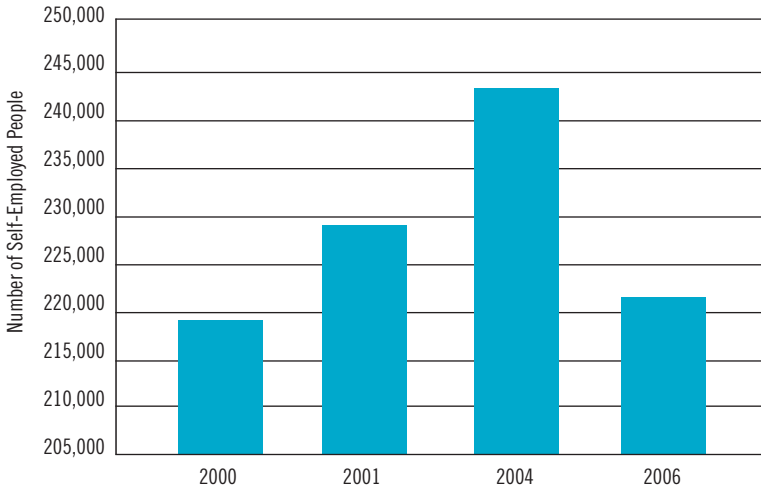
Trends in the Multiple Jobholding Rate in Massachusetts, 2000-2006, Selected Years



Source: Monthly CPS household surveys, public use files, tabulations by authors.

Chart 16:

Trends in the Level of Self-Employment in Massachusetts, 2000-2006, Selected Years



Source: Monthly CPS household surveys, public use files, tabulations by authors.

Similar developments took place in the severe state recession of the late 1980s and early 1990s. Self-employment rose sharply during these depressed labor market conditions, especially among laid-off professionals and managers. It should be noted that, as payroll employment expanded in our state over the past two years, self-employment declined by nearly 22,000.

Fourth, interviews by CLMS research staff with employers and workers in a broad array of occupations and industries across the state and in other states across the country over the past few years have revealed substantive growth in the number of persons working as independent contractors, particularly through 2004. Persons holding such independent contractor positions were hired by private firms and some government agencies but do not appear on their formal payrolls. Instead, they are paid wage and salary incomes on a 1099 tax form basis without any employee benefits or any contributions to the state's unemployment insurance fund. Some are paid a fixed monthly or annual salary, some are hired by the hour, and others are paid a fixed amount for a given job that they bid for. Among the examples of such employment arrangements are the following:

- A former bank survey research analyst who was laid off after his bank was acquired and went to work as a market analyst for a large investment services firm as an independent contractor;
- A former bank economist who was laid off from his position and went to work part-time as an independent contractor operating out of his home.
- Journalists hired as free lance workers by newspapers and magazines.
- Individual laborers working for a roofing company on Cape Cod.
- A retired state employee working as a contractor for a research firm.
- Engineers working for a large defense contractor.
- New graduates of computer science programs working for a software company in Kendall Square.

The above workers will not be reported as wage and salary workers on the monthly CES payroll survey, but they would show up as employed on the CPS household survey, mostly as wage and salary workers. The growth of these independent contractors, thus, will create a gap between the employment change estimates of the CES and CPS employment surveys. In an economic downturn, CES payroll employment estimates will decline more steeply than LAUS employment estimates. The opposite may well occur during more prosperous times as some of these independent contractors become employed as formal wage and salary workers. This happened during the strong job growth years from 1995 to 2000 and appears to be occurring in our state over the past 18 months.

Fifth, there are those workers, including both native born workers and undocumented immigrants, who work completely off the books or "under the table." They may be paid on an hourly basis, a daily basis, or a flat fee basis, but their earnings are not reported by the employer to the state or national government. The underground economy, which also includes some self-employed individuals including landscapers, carpenters, and auto mechanics, is a cash basis economy. Estimating the precise increase in the number of Massachusetts residents employed as independent contractors or "off the books" workers over the past few years is complicated by the absence of hard survey data on the number of such work-

ers. Independent contractors and many persons working off the books will likely report themselves as wage and salary workers on the CPS household survey; however, the CPS labor force questionnaire does not probe respondents sufficiently to identify the specific nature of their employment relationship with the firms that hire them. Certain industries, including retail trade, eating and drinking places, construction, personal services, housecleaning, and landscaping, appear to be more intensive users of off-the-books workers. Some of these workers admit to being paid partly in cash and partly off the books by their employers.

Sixth, both nationally and in the state, the number of private household workers (domestics, cleaning persons, live in attendants for the disabled) has been rising. The findings of the national CPS surveys for 2001 to 2006 indicate that the number of private household wage and salary workers has increased by about 110,000 or 15 percent over this five year period. Most private household workers will be captured by the CPS household survey but not by the CES payroll survey. The owners of these home cleaning businesses will be expected to report themselves as self-employed, but field interviews and off-the-record conversations with owners of these businesses in the Boston metro area and on Cape Cod reveal that many of their employees, including native born workers and undocumented immigrants, are paid off the books. Neither UI taxes, nor Social Security taxes, nor income taxes are withheld from their payrolls. None of these workers will appear on the CES payroll employment estimates but some may report their employment on the CPS survey. Rising private household employment, thus, has contributed to the gap between CES and LAUS employment estimates in both the state and the nation.

Finally, there are some labor market analysts, including former Secretary of Labor Robert Reich, who have argued that during downturns in the labor market some of the newly unemployed, especially managers and professionals, are reluctant to admit to CPS interviewers that they are without work. They may cite some consulting work or fictitious independent contractor/self-employment position to the interviewer rather than report that they are completely jobless. During the severe job market downturn from early 2001 through the end of 2003, there was a rise in the number of persons, including professionals and managers, who reported themselves as either self-employed or employed part-time for economic reasons. Some of these positions may have been fictitious. As Barbara Ehrenreich wryly noted in her recent book on the trials and tribulations of unemployed professionals and managers, "In fact, in a practical sense, I was simply changing my occupational status from 'self-employed writer' to 'unemployed'- a distinction that might be imperceptible to the casual observer."[7] When the state economy improved and new payroll positions were created, some of these "virtual workers" would have obtained formal payroll jobs thereby boosting the CES employment estimate while leaving the LAUS employment estimate unchanged. In addition, several of the independent contractors noted above were offered formal positions in their firms after completing a year or two of independent contractor work.

WORKERS ARE SHIFTING ONTO FORMAL PAYROLLS AS ECONOMIC CONDITIONS HAVE IMPROVED.

The findings for the CES and LAUS surveys on employment changes in Massachusetts since

the first quarter of 2004 reveal a narrowing of the gap between the employment estimates of the two series. This suggests that firms are adding workers to their payrolls at a faster pace than additional state residents are reporting themselves as employed in the household survey. This somewhat paradoxical finding can be explained by a shift of workers from the ranks of the self-employed, independent contractor positions, and off-the-books workers onto the formal payrolls of employers as economic conditions have improved. During the past two years, state government has taken a somewhat harder stance on firms use of workers as independent contractors, and the Internal Revenue Service has monitored more closely wage reporting by a number of retail and service sector employers. Some workers reported to us that they had shifted from independent contractor positions and off the book jobs to formal payroll positions. Some illegal immigrants remain employed off the books and will not appear on the formal payrolls of these firms or the wage records of companies covered by the UI laws. A recent study by a construction research group at Harvard University found that Massachusetts' was losing $12.6 to $35 million in unemployment insurance tax revenue due to the misclassifying of workers on 1099 forms.[8]

Payroll job growth clearly has been improving over the past few years and the number of job vacancies also has been rising in many industries and occupations, suggesting that firms are also trying to expand their payroll employment levels more rapidly than the available supply of labor will allow. The existence of rising job vacancies provides a potentially important role for job placement and job training strategies to more efficiently match the available stock of job vacancies with the pool of unemployed and underemployed workers in the state.

Endnotes

1. For a more detailed overview of the LAUS methodology for estimating state and local employment and unemployment, *See*: U.S. Bureau of Labor Statistics, *BLS Handbook of Methods*, web site, www.bls.gov.
2. Andrew Sum, Paul Harrington, et.al., *The Missing 500,000 Workers in New England: The Gap Between the CES and CPS Estimates of Employment Change, 1992-2000*, Center for Labor Market Studies, Northeastern University, Boston, 2003.
3. For an earlier assessment of differences between these two surveys' estimates of employment change in Massachusetts, *See*: Andrew Sum, Paul Harrington, Ishwar Khatiwada, et.al., *Another Look at Employment Developments in Massachusetts Since the End of the Labor Market Boom in 2000: What is the Real State of Massachusetts Labor Markets?*, Center for Labor Market Studies, Northeastern University, Boston, April 2004.
4. Some multiple jobholders are self-employed and hold a regular wage and salary job. If these individuals kept their self-employment position but lost their wage and salary job, payroll employment would decline while LAUS employment would have remained unchanged. If they lost their self-employment position, the employment counts from both surveys would be unchanged.
5. The bulk of these in-commuters into Massachusetts in 2000 and 2004 came from Rhode Island and New Hampshire.
6. The self-employed who incorporated their businesses and treated as wage and salary workers in the CPS employment survey.
7. Barbara Ehrenreich, *Bait and Switch: The Futile Pursuit of the American Dream*, Metropolitan Books, Henry Holt and Company, New York, 2005.
8. Francoise Carre and Randall Wilson, "The Social and Economic Costs of Employee Misclassification in Construction," Construction Policy Research Center, Harvard University, December 2004.

VI. THE REAL OUTPUT PERFORMANCE OF THE MASSACHUSETTS ECONOMY AND LABOR PRODUCTIVITY

As noted earlier in this report, from the end of the 1980s through calendar year 2000, Massachusetts was characterized by two quite distinct periods of economic performance. From 1989 through 1991, the state experienced steep declines in real aggregate output, wage and salary jobs, and the real incomes of its families. Unemployment rose steadily and strongly from 1988 through 1992, when the state's overall unemployment rate peaked at 8.6 percent, more than one full percentage point above the national average of 7.5 percent. From 1992 through 2000, however, the state's economy produced steady and strong gains in real output, created more than 500,000 net new wage and salary jobs, and lowered its unemployment rate to 2.6 percent by 2000, the lowest rate in the past 35 years for which such unemployment data have been available. The 1990s, thus, represented a combination of the best of times and the worst of times for the Commonwealth.

Future events would prove that the end of calendar year 2000 would mark the end of the sustained period of recent economic prosperity for the state. Beginning in early 2001, there would be a steady decline in the number of wage and salary jobs, rising unemployment, and declining real wages and earnings. Payroll employment continued to decline from the first quarter of 2001 through early 2004.

Assessing the economic performance of a state or regional economy over time can be a rather complex undertaking for a variety of reasons. First, there are a diverse array of economic performance measures that can be used by labor market economists, state and regional economic analysts, regional scientists, other social scientists, and the media to assess the economic performance of a state, region, or nation over time. These measures include changes in the number of wage and salary jobs, aggregate employment opportunities including self-employment and independent contractor employment, the unemployment rate, labor productivity, real wages and earnings of workers, personal incomes, per capita incomes, and real aggregate output growth. These economic indicators are not only used as key barometers to assess the state of the economy at a given point in time and changes in its economic fortunes over time, but many of these measures are also viewed as key performance indicators to assess the economic well being of a state's residents, its workers and their families.

NEARLY ALL OF THE GAINS WERE A RESULT OF INCREASED LABOR PRODUCTIVITY.

Second, as noted in our introductory section, changes in these measures often tend to be interrelated. For example, the growth of real output of a state is dependent on the growth in employment, annual average hours of work, and labor productivity. These variables interact with each other in a multiplicative way to influence real output. Third, not all of these measures change at similar rates over time and some can, in fact, move in opposite directions from each other. For example, labor productivity in Massachusetts improved during the 1989-1991 recession and the 2000-2004 period while wage and salary job opportunities declined considerably.

One key economic performance measure that we will analyze in this section of the paper is

the aggregate real output performance of Massachusetts as measured by its real Gross State Product (GSP).[1] Knowledge of the real output performance of a state's economy is important for a variety of reasons. First, growth in aggregate real output and in a state's resident population over time will determine changes in real output per capita. Real GSP per capita is the primary determinant of a state's average economic living standards. Growth in per capita public and private consumption expenditures is largely dependent on growth in GSP per capita. Our state's current and future consumption prospects are, thus, very dependent on our real output performance. Second, the growth of real GSP is influenced by a number of key labor market variables, including the labor supply behavior of residents, the utilization rates of the available labor supply, and labor productivity; i.e., real output per worker. Understanding the links between these key labor market variables and the real output performance of state and regional economies is indispensable for designing economic development and workforce development strategies that can contribute to long run economic growth. Third, the available GSP data can be used to track the industrial composition of a state's output at a point in time and changes in the industrial sources of growth and decline in a state's real output over time.[2] Such analyses also can be helpful in guiding future economic development and employment and training policymaking at the state and local level.

All of the aggregate output measures for the Massachusetts economy in this section represent estimates of Gross State Product. Gross State Product (GSP) is a core measure of aggregate production activity within a state. It measures the total market value of all goods and services produced by the property and labor that is physically located in a state during a calendar year. GSP also can be considered as the sum of the value added produced by the labor and property inputs in a state. It represents the sum of the compensation paid to employees (including payroll taxes and employee benefits), property income, indirect business taxes, capital depreciation, and related liabilities. One important point to note here is that the labor, property, and land inputs are measured by their physical location in the production process not by the physical residences of the workers or the owners of the capital and land. For example, the output of a Rhode Island or New Hampshire resident who commutes to Massachusetts for his/her work is considered part of the GSP of Massachusetts.[3] On the other hand, a Massachusetts worker who commutes to Connecticut adds to the real GSP of Connecticut. A British or Canadian firm that operates in Massachusetts contributes to the GSP of the Commonwealth though part of the incomes generated by the firm may leave the state.

The values of the Gross State Products for states are generated by the U.S. Bureau of Economic Analysis from adding the GSP originating in all industries (value added) in a state during a calendar year. The concept of "value added" underlies the calculation of the nation's GDP and each state's GSP. Value-added is derived by taking the market value of gross output less all intermediate inputs from other industries including those in other states and nations. The U.S. Commerce Department's Bureau of Economic Analysis provides time series data on both nominal and real Gross State Product for each state. Our analyses are based on the Bureau of Economic Analysis' Gross State Product series for states measured either in constant 1996 prices or in 2000 prices.

The nominal GSP estimates for states are not adjusted for the effects of price changes over time and are, thus, misleading as a measure of

real output changes. The U.S. Department of Commerce's Bureau of Economic Analysis also produces estimates of real GSP by adjusting nominal GSP estimates for changes in the prices of goods and services. A separate price deflator is used for each individual industrial sector of the economy, but the price deflator for an industry is assumed to be the same across all states.

The real GSP of Massachusetts (in constant 1996 dollars) is estimated to have increased from $193.8 billion in 1989 to $269.3 billion in 2000, a gain of nearly $76 billion or 39.0 percent over the 1989-2000 period (Table 33). This represented an annual compound growth rate of 3.0 percent. Massachusetts's growth rate of aggregate real output lagged modestly behind that of the nation as a whole over the 1990s; however, the rate of growth of real GSP in Massachusetts was slightly higher than that for the entire New England region. The annual growth rate of the nation's real output during the 1989-2000 period was 3.3 percent while that of New England's was only 2.8 percent.

How did Massachusetts fare in terms of real GSP growth during the severe state and regional recession of 1989 to 1991 and during the long economic boom of the 1990s? Chart 17 displays the growth rates of real GSP in Massachusetts, New England, and the U.S. during the regional recession and jobless recovery of 1989 to 1992 and during the long national and regional economic expansion of the 1990s. Massachusetts and the New England region entered into a severe recession in early 1989 well before the onset of the national recession. The national recession officially began in July 1990 and ended in March 1991 and had severe negative impacts on the New England economy. Real GSP in Massachusetts and New England declined by 6 percent and 5 percent, respectively, between 1989 and 1991 whereas it grew by one percent in the nation during the same time period. The growth rate of real GSP in Massachusetts during the economic boom that began in 1992 and continued through 2000 was very substantial and exceeded the growth rates for the national and New England economies. For example, between 1992 and 2000, real GSP of the Massachusetts economy grew by 47 percent compared with 40 percent for New England and 37 percent for the entire nation (Chart 17).

Table 33:

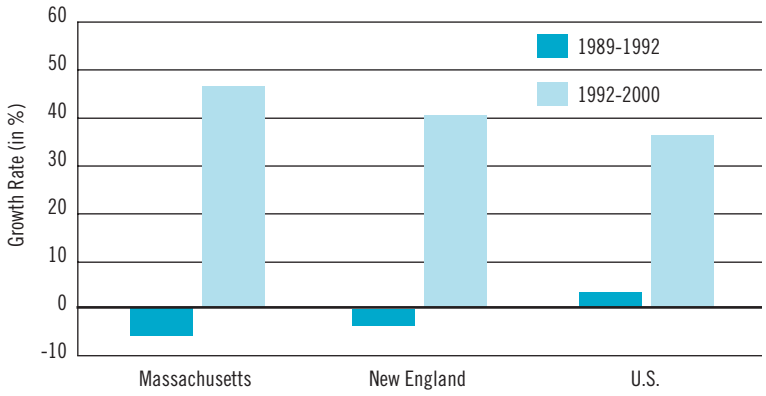
Trends in Real Output for U.S., New England, and Massachusetts, Selected Years, 1989-2000 (in Millions of Chained 1996 Dollars)

YEAR	MASSACHUSETTS	NEW ENGLAND	US
1989	$193,839	$407,229	$6,538,634
1991	181,901	388,572	6,615,685
1992	182,789	391,385	6,774,505
1995	200,537	422,524	7,433,965
1999	251,482	517,174	8,915,954
2000	269,308	549,304	9,314,279

Data Source: U.S. Department of Commerce, Bureau of Economic Analysis.

Chart 17:

Growth Rate of Real GSP in Massachusetts, New England, and the U.S., Selected Time Periods, 1989-1992 and 1992-2000



Trends in Real GSP Per Capita in Massachusetts, New England, and the U.S., 1989 to 2000

Real GSP per capita is often considered as the most appropriate measure of the output performance of a state, regional or national economy during a calendar year since it adjusts the aggregate output measures for the effects of population growth over time. In this section, we provide estimates of per capita real GSP for Massachusetts, New England, and the U.S. by dividing real GSP by the size of the resident population in each geographic area. The BEA uses state, regional and national population estimates generated by the U.S. Census Bureau, and these population estimates pertain to July 1st of each year. These population counts cover all age groups and include inmates of institutions, such as jails, prisons, and nursing homes, but exclude the homeless. It should be noted, however, that the per capita GSP measure does not tell us anything about the distribution of the output among various demo-

Table 34:

Trends in Real Output in the, U.S., New England, and Massachusetts, 1989-2000 (in Chained 1996 Dollars)

	REAL OUTPUT (IN MILLIONS)			ANNUAL GROWTH RATES[1]		
	1989	1992	2000	1989-1992	1992-2000	1989-2000
U.S.	6,538,634	6,774,505	9,314,279	1.2	4.1	3.3
New England	407,302	391,446	549,372	-1.3	4.3	2.8
Massachusetts	193,839	182,789	269,308	-1.9	5.0	3.0

Data Source: U.S. Department of Commerce, Bureau of Economic Analysis.
Note: (1) All of the growth rates represent annual compound growth rates over each time period, not simple averages relative to the base year of the analysis.

Table 35:

Real Output Per Capita in the U.S., New England, and Massachusetts, Selected Years, 1989-2000 (In 1996 Chained Dollars)

YEAR	US	NEW ENGLAND	MASSACHUSETTS	MA / U.S.	MA RANK AMONG 50 STATES
1989	$26,492	$30,899	$32,223	1.216	7
1991	$26,151	$29,338	$30,224	1.156	8
1992	$26,410	$29,496	$30,320	1.148	8
1995	$27,918	$31,362	$32,653	1.170	6
1997	$29,685	$33,975	$35,290	1.189	5
1999	$31,952	$37,378	$39,808	1.246	3
2000	$33,015	$39,399	$42,364	1.283	2

	U.S.	N.E.	MASSACHUSETTS
Absolute Change, 1989-2000	$6,532	$8,500	$10,141
Percent Change, 1989-2000	24.6	27.5	31.4

Data Source:U.S. Department of Commerce, Bureau of Economic Analysis, tabulations by authors.

graphic or socioeconomic groups within a state. It is simply an average output concept.[4]

In this section, we provide comparisons of Massachusetts' per capita real output performance with that of the nation and the New England region over the 1989-2000 period. At the end of the 1980s, Massachusetts's per capita real output was $32,233 and ranked seventh highest among the 50 states. By 2000, the state had become one of the star performers in terms of per capita real output in the nation, ranking second highest (Table 35). The per capita real output of Massachusetts in 1989 and throughout the 1990s was modestly above that of the New England region and well above that of the nation as a whole. The growth rate of per capita real output of the state surpassed that of the New England region and the entire nation during the 1989-2000 period. Per capita real GSP of Massachusetts was only 4 percent higher than that of New England in 1989, but increased to nearly 8 percent above the New England average by calendar year 2000 (Table 35). In the latter year, per capita real output of Massachusetts was 28 percent higher than that of the nation, an all time high (Table 35).

The Sources of Growth of Real Output in Massachusetts from the Late 1980s to 2000: Findings of the Supply GDP Methodology

There are a variety of demographic, labor supply, labor market and technological factors, including labor productivity, that influence the per capita output performance of a regional or state economy. Knowledge of trends in the values of each of these variables, their contribution to per capita output levels at any point in time, and their contribution to growth of per capita output over time would be very helpful in assessing the past sources of real output growth and in formulating future economic policies to stimulate economic growth.

One methodology used to identify the sources of per capita GSP in a state at a point in time and the sources of growth in per capita GSP over time is known as the supply GDP model.[5] According to this economic accounting model, the annual value of the GSP of a state can be viewed as the product of five demographic variables, labor force attachment, labor force utilization, and labor productivity variables. GSP per capita is simply the product of these five variables divided by the size of the state's resident population (P).

Chart 18:

Disaggregating the Sources of GSP of a State's Economy

GSP = Pw * L/Pw * E/L * H/E * GSP/H

Where,	Pw	=	The number of persons 16+ in the state's resident, civilian non-institutional population.
	L	=	The number of working-age persons (16+) who either worked or looked for work on an average month during the year.
	E	=	The number of working-age persons who were employed on an average month during the year.
	H	=	The mean annual hours of paid employment among the employed residents of a state.
	GSP/H	=	Real output per hour of paid employment in the state.
	GSP/P	=	Pw/P * L/Pw * E/L * H/E * GSP/H
Where,	GSP/P	=	Per capita real gross state product.
	P	=	Total resident population of the state.

Table 36:

Trends in Real GSP Per Capita in Massachusetts and the U.S. and Their Underlying Determinants, 1989-2000 (GSP in Constant 1996 Dollars)

MASSACHUSETTS	1989	2000	PERCENT CHANGE
Real GSP Per Capita	$32,223	$42,417	31.6
Pw/P	78.3	78.9	0.7
L/Pw	68.9	67.6	-1.9
E/L	96.0	97.3	1.3
H/E	1,772	1,842	4.0
Y/H	$32.06	$42.12	31.4

UNITED STATES	1989	2000	PERCENT CHANGE
Real GSP Per Capita	$26,492	$33,097	24.9
Pw/P	76.5	76.8	0.3
L/Pw	66.5	67.2	1.1
E/L	94.7	96.0	1.3
H/E	1,798	1,872	4.1
Y/H	$27.72	$33.62	21.3

Source: (i) Public use files, Current Population Survey (CPS), U.S. Census Bureau and U.S. Bureau of Labor Statistics; (ii) Bureau of Economic Analysis, U.S. Department of Commerce; (iii)Population Division, U.S. Census Bureau.

Table 37:

Trends in Real GSP Per Paid Hour of Employment in the U.S. New England, and Massachusetts, 1989 and 2000 (in Constant 1996 Dollars)

				RANKINGS AMONG 9 DIVISIONS/50 STATES	
GEOGRAPHIC AREA	1989	2000	PERCENT CHANGE	1989	2000
United States	$27.63	$33.48	21.2		
New England	$29.93	$39.12	30.7	3	2
Massachusetts	$31.99	$42.03	31.4	7	3

The first variable in the model (Pw / P) is a demographic variable representing the age structure of the state's resident population. The GSP per capita of a state during any year will be influenced in part by the share of its resident population that is of working-age 16 and older (Pw/P).[6] The higher the ratio of Pw/P, the greater is the state's potential GSP per capita since a larger share of the resident population is potentially available for work. In Massachusetts and the U.S., the value of the Pw/P ratio in 2000 was 0.7 and 0.4 percentage points above their 1989 values, respectively (Table 36).

The second variable in the supply GDP model (L/P) is a measure of the degree of attachment to the labor force by a state's working-age residents. The labor force attachment of a state's working-age population also will have an independent influence on its output potential. The overall labor force participation rate in Massachusetts is estimated to have declined in the 1990s from 68.9 percent to 67.6 percent due to the reduced labor market attachment of men. This variable did not contribute positively to the growth of the state's real output over the 1990s.

While higher rates of labor force participation can raise the levels of real output of a state, labor force participants can only contribute to the real output performance of a state's economy by becoming employed. The variable E/L is a measure of labor force utilization and is based on the employment experiences of labor force participants throughout the year. This variable measures the fraction of the state's labor force participants who were employed on average during the calendar year. The ratio of E/L in Massachusetts in 2000 was 1.3 percentage points higher than in 1989 due to a lower rate of unemployment, matching an increase in the E/L ratio for the entire nation. In 2000, the unemployment rate of the state was estimated to be only 2.6 percent, the lowest unemployment rate ever recorded for the state in the 33 year period for which state CPS data are available.

The variable H/E represents the mean hours of paid employment among those state residents who were employed during the year.[7] The real output of a state's economy is dependent upon the intensity of employed persons' work experi-

ences during the year. Mean annual hours of paid employment in Massachusetts increased by 70 hours or 4.0 percent over the 1989-2000 period, approximately the same as the increase in mean paid hours of annual work among all the employed in the U.S.

The final variable in the model is a labor productivity variable. Our labor productivity variable (Y/H) is a standard partial labor productivity measure, representing the value of real output (GSP) per hour of paid employment. The value of this labor productivity variable represents not only the contributions of labor skills and abilities, but also the quantity and quality of the physical capital and information technology with which labor worked, the amount of accompanying energy and material inputs, and the quality of management. Labor productivity improvements are one of the most desirable ways to improve real output per capita since these gains do not come at the expense of leisure time or home output, and they are believed to be critical to raising the real wages and earnings of residents in the long-run. As will be noted in a following section, however, the links between the productivity gains of workers in industries of Massachusetts and the U.S. and their real wage gains have been substantially diminished in recent years.

As noted above, there was a substantial improvement in real GSP per capita in Massachusetts in the 1990s. Nearly all of the gain in real GSP per capita in Massachusetts and the New England region was attributable to gains in labor productivity (31%). The New England region had the second highest gain in real GRP per hour of work, only trailing the Mountain division over the 1989-2000 period. By 2000, Massachusetts ranked third highest among the 50 states in its labor productivity performance, trailing only Connecticut and New York.

The Growth of Real Output and the Sources of Growth of Real Output in Massachusetts, 2001 to 2005

During March of 2001, the U.S. economy entered a recession that lasted till November 2001 according to the analyses of the National Bureau of Economic Research (NBER). While the nation's real Gross Domestic Product declined during the recession, real output for the year as a whole (2001) was slightly above that of the previous year, a gain of $73 billion or 0.8 percent. Real output grew more strongly over the following two years (2002-2003) despite a largely jobless recovery through the late summer of 2003, and the national economy gained additional strength in 2004 and 2005. For the five year period as a whole, the nation's real aggregate output as measured by the Gross Domestic Product increased by $1,231 billion or 12.5 percent.

MASSACHUSETTS OUTPACED THE NATION IN PRODUCTIVITY GAINS.

How well did the Massachusetts economy fare over the same time period? To answer this critical question, we analyzed BEA estimates of real Gross State Product of the Massachusetts economy each year over the entire 2001-2005 period and tracked sources of growth in real GSP per capita over the 2001-2005 period. As noted earlier, wage and salary employment growth in Massachusetts came to an immediate halt in the early spring of 2001 as the national economic recession set in. Payroll employment declined considerably in Massachusetts from March 2001 through the end of the calendar year and payroll job losses continued through the end of 2003. Similar to U.S. developments, real output of the Massachusetts economy (in constant 2000 dollars)

Table 38:

Trends in Real GSP Per Capita in Massachusetts and the U.S. and Their Underlying Determinants, 2001-2005 (GSP in Constant 2000 Dollars)

MASSACHUSETTS	2001	2005	PERCENT CHANGE
Real GDP (In Millions)	$276,634	$297,489	7.5
Real GDP Per Capita	$43,179	$46,242	7.1
Pw/P	78.4	79.7	1.7
L/Pw	68.0	66.9	-1.6
E/L	96.3	95.0	-1.3
H/E*	2,117	1,907	-9.9
Y/H*	$39.83	$48.69	22.2

UNITED STATES	2001	2005	PERCENT CHANGE
Real GDP (In Millions)	$9,836,576	$11,043,400	12.3
Real GDP Per Capita	$34,487	$37,245	8.0
Pw/P	77.0	77.7	0.8
L/Pw	67.0	66.3	-1.1
E/L	95.2	94.9	-0.3
H/E	2,032	2,025	0.4
Y/H	$35.29	$38.37	8.7

Source: (i). Monthly Current Population Survey (CPS) public use files, 2000 and 2004, U.S. Census Bureau and U.S. Bureau of Labor Statistics. (ii). *Bureau of Economic Analysis*, U.S. Department of Commerce. (iii). *Population Division*, U.S. Census Bureau

Note: *Mean annual hours worked (H/E) is estimated from the U.S. Census Bureau's Annual Social and Economic Supplements (ASEC) surveys. The numerator (H) is the hours worked by all those who were employed at some point during 2001 and 2005. The denominator (E) is the average employment in 2001 and 2005. For this reason, our estimates of H/E is upward biased as the aggregate hours worked is for all those who worked. The survey estimates revealed that between 2004 and 2005 aggregate annual hours worked in Massachusetts declined from 6.329 billion hours to 6.110 billion hours, a decline of 219 million hours or 3.5% in a single year. This estimates change in difficult to accept since more people worked in 2005 and labor market conditions improved. We consider this a statistical outlier.

grew very slightly in 2001 (0.6%) despite the national and state recession, but is estimated to have declined by 0.6 percent in 2002. The state's level of real GSP in 2002 was back to where it was in 2000. Since 2002, real output in the state has increased steadily, rising to $300 billion in 2005. Real GSP in latter year was $25 billion or more than 7 percent higher than it was in 2001. Real output growth in the state over the 2001-2005 period fell below that of the nation (12.3% vs. 7.5%).

The growth in the real output of the state economy over the 2001-2005 period despite losses in payroll employment indicate that some combination of labor productivity gains, increases in annual hours of work per employee, or a rise in self-employment/independent contractors must underlie the continued growth in the real output of the state over the past four to five years.[8] To identify the role of demographic, labor force participation, annual hours of work, and labor productivity variables in influencing the growth of real GSP per capita in the state over the 2001-2005 period, we applied the Supply GDP model used in the preceding section to examine the sources of real output growth in the state and the nation over the 2001-2005 period.

The state's performance on this key output measure (real output per capita) was slightly lower than that of the nation (8.0% for the nation vs. 7.1% for Massachusetts) over the 2001-2005 period (Table 38). The much lower rate of population growth in the state over this four-year period was responsible for this result. The resident population of Massachusetts between 2001 and 2005 grew by only 27,000 or by 0.4 percent, well below the national average of 4.0 percent, and our population growth rate ranked second lowest among the 50 states. Hence, the higher growth rate of GSP boosted the per capita real GSP of the state from $43,179 in 2001 to $46,242, an increase of slightly more than 7 percent during this period.

In Massachusetts, the working-age population's share of the total population (Pw/P) increased from 78.4 percent in 2001 to 79.7 percent in 2005, a 1.3 percentage point increase. The value of this demographic variable for the entire nation rose slightly during the same time period (77.0% in 2001 vs. 77.7% in 2005) (Table 38).

The labor force participation rate of the Massachusetts' working-age population (L/Pw) declined by 1.1 percentage points over this four year period. The overall labor force participation

rate in Massachusetts fell from 68.0 in 2001 to 66.9 in 2005. The value of the L/Pw variable also declined for the U.S. from 67.0 percent in 2001 to 66.3 percent in 2005. This decline was primarily due to reduced labor market attachment of men across the nation.

Since there was no payroll job growth in the state between 2001 and 2005, the unemployment rate rose and the employment rate for those residents in the labor force (E/L) in Massachusetts declined from 96.3 percent in 2001 to 95.0 percent in 2005, a 1.3 percent decline. For the entire nation, the value of E/L remained basically unchanged during the same time period.

The real output of a state's economy is also dependent upon the intensity of employed persons' work experiences during the year. The mean annual hours of work among the employed (H/E) in Massachusetts declined by 210 hours or 9.9 percent over the 2001-2005 period, while for the entire nation, mean hours declined only by 7 hours or 0.4 percent.

Since the state's overall employment rate and the mean annual hours of work declined between 2001 and 2005, labor productivity had to account for all of the state's growth in real GSP per capita. The labor productivity variable (Y/H) for Massachusetts is estimated to have increased from $39.83 in 2001 to $48.69 in 2004-2005, an increase of $9 or slightly more than 22 percent while labor productivity for the entire nation grew by a more modest 8.7 percent. This above-average increase in the value of Y/H in the state was attributable to reductions in annual work hours by employers. Employers were opting not to hire additional workers or increase annual hours worked but instead relied on increased output per hour of work to boost their output.

Table 39 compares the percentage changes in the value of each Supply GSP model variable between 2001 and 2005 for Massachusetts and the U.S. For each variable, Massachusetts growth rate is ranked among all 50 states. The Massachusetts growth of aggregate real output was well below the national average and the state ranked only 47th on this measure, i.e., the fifth lowest rate of output growth among the 50 states and D.C. Massachusetts real GSP per capita grew between 2001 and 2005 at a rate slightly below that of the nation, but Massachusetts' ranking was only 36th highest on this measure. The state also performed poorly relative to the other states in the percentage point change in its employment rate and annual hours of work (50th), or second to last. In contrast, labor productivity in Massachusetts (real output per hour of work) rose by 22 percent. The growth rate of real output per hour in Massachusetts between 2001 and 2005 ranked the highest among the 50 states and the District of Columbia.

Table 39:

Percent Changes in the Value of Supply GDP Model Variables Between 2001 and 2005, Massachusetts Vs. U.S.

	MA	U.S.	MA RANKING AMONG 50 STATES
Real GSP	7.5	12.3	47th
Real GSP Per Capita	7.1	8.0	36th
Pw/P	1.7	0.8	22nd
L/Pw	-1.6	-1.1	37th
E/L	-1.4	-0.3	45th
H/E	-4.6	0.5	50th
Y/H	22.2	8.7	1st

AVERAGE WEEKLY EARNINGS OF WORKERS IN MASSACHUSETTS REMAINED FLAT.

The Severed Links Between Labor Productivity Growth and the Real Weekly Earnings of Massachusetts and U.S. Workers, 2001 to 2005

Over the long run, improvements in the real wages of U.S. workers have been dependent on growth in labor productivity; i.e., real output per worker or per hour of work. The strength of these links between real wage growth and productivity growth had, however, diminished considerably in a number of key sectors in the 1980s. For example, the links between labor productivity growth and the real wages of production workers in U.S. manufacturing industries became completely severed in the 1980s.[9] From the mid-1990s through the end of the decade, however, stronger growth in labor productivity and a movement toward full employment in the nation's labor markets led to renewed growth in the real weekly wages of full-time workers and the weekly earnings of the nation's production workers in the private sector. In the U.S., the median real weekly earnings of full-time wage and salary workers rose by seven percent between 1996 and 2000 while the mean weekly earnings of production workers in nonfarm industries rose by 6 percent over the same time period.[10] In Massachusetts, mean weekly earnings of full-time wage and salary workers rose by slightly over 4 percent between 1994 and 2000, while mean weekly wages of workers in covered industries rose by 20 percent over the same time period. As noted below, the weekly earnings estimates based on the ES-202 wage reports captured CEO and manager bonuses, annual profit sharing, and value of stock options awarded to workers and managers as well as regular wage and salary payments.[11]

THE LINKS BETWEEN PRODUCTIVITY AND EARNINGS MUST BECOME RE-ESTABLISHED.

Labor productivity in Massachusetts and the U.S. as measured by real output per payroll worker rose steadily from 2001 through 2005, but national evidence has revealed that workers' real wages were basically flat over this time period.[12] In Tables 40 and 41, we present our estimates of the growth in real output per payroll worker in Massachusetts and the U.S. over the 2001-2005 period.[13] Real Gross State Product in Massachusetts increased by nearly $21 billion or 7.5 percent between 2001 and 2005 (Table 40). Over the same time period, payroll employment in the state fell by 3.5 percent; thus, real output per worker increased by 11.5 percent. In the U.S., real output growth (12.2%) was sharply higher over this four year period than it was in our state; however,

Table 40:

Trends in Real Gross State Product, Payroll Employment, and Real Output Per Worker in the State of Massachusetts 2001-2005 (in Constant 2000 Dollars)

VARIABLE	2001	2005	ABSOLUTE CHANGE	PERCENT CHANGE 2001-2005
Real Gross State Product (in Billions of Constant 2002 Dollars)	$276.6	$297.5	$20.9	+7.5
Payroll employment (in 1000s)	3,276	3,160	-116	-3.5
Real Output Per Worker	$84,430	$94,150	$9,720	+11.5

Sources: (i) U.S. Commerce Department, Bureau of Economic Analysis, web site; (ii) Massachusetts Division of Unemployment Assistance, Current Employment Statistics Programs, web site.

Table 41:

Trends in Real Gross Domestic Product (GDP), Payroll Employment, and Real Output Per Worker in the U.S., 2001-2005 (in Constant 2000 Dollars)

VARIABLE	2001	2005	ABSOLUTE CHANGE	PERCENT CHANGE 2001-2005
Real Gross Domestic Product (in Billions of Constant 2002 Dollars)	$9,837	$11,041	$1,205	12.2
Payroll employment (in 1000s)	129,638	131,572	1,936	1.5
Real output per worker	$75,879	$83,920	8,041	10.6

Source: (i) U.S. Department of Commerce, Bureau of Economic Analysis, web site; (ii) U.S. Bureau of the Census.

national payroll employment rose modestly by 1.5 percent over this four year period (Table 41). As a result, labor productivity growth in the nation as measured by real output per payroll worker was slightly below the pace for our state (10.6% vs. 11.5%).

How well did Massachusetts and U.S. workers fare in improving their weekly real earnings over the 2001-2005 period as a consequence of this rise in labor productivity? To answer this key question, we analyzed weekly earnings data from both the CPS household survey and the Quarterly Census of Employment and Wages' administrative data base for workers in Massachusetts and the U.S. who were covered by the provisions of state unemployment insurance laws.

The estimates of the weekly earnings of Massachusetts workers appearing in this section of the report are derived from two different data sources, and the underlying weekly earnings measures do differ somewhat conceptually. There are two primary sources of data on the weekly earnings of Massachusetts wage and salary workers. The first is the monthly Current Population Survey typically referred to by its acronym the CPS. This household survey conducted by the U.S. Census Bureau for the U.S. Bureau of Labor Statistics collects information on the labor force and employment status of all sample household members 16 and older.[14] Hourly and weekly earnings data are collected from a sample of persons employed in wage and salary jobs.[15] The "usual weekly earnings" data are intended to measure the usual weekly earnings of the worker before taxes and any other payroll deductions, such as health insurance and pension contributions. The CPS weekly earnings data include overtime pay, commissions, and tips usually received on the main job, but exclude annual bonuses, profit sharing, and stock options. The wage data are collected only for wage and salary workers. The earnings of the self-employed are excluded as well as unpaid family workers. In our analysis of the CPS data, we will focus on the weekly earnings of the full-time employed, i.e., those working for 35 or more hours.

Our second source of weekly earnings data for Massachusetts wage and salary workers is the labor compensation data reported by public and private employers on a quarterly basis to the Massachusetts Division of Unemployment Assistance. The earnings data appearing in these administrative records of firms are reported in an aggregate form by employers covered by the provisions of the federal and state unemployment insurance laws. The labor compensation data from the ES-202 data are broader in coverage than the CPS usual weekly earnings data.

Table 42:

Trends in the Median and Mean Real Weekly Earnings of Full-Time Wage and Salary Workers and Workers Covered by the Provisions of the Massachusetts and U.S. Unemployment Insurance Laws, 2000-2005 (in Constant 2005 Dollars)[1]

MASSACHUSETTS			
YEAR	MEDIAN WEEKLY EARNINGS OF FULL-TIME WAGE AND SALARY WORKERS	MEAN WEEKLY EARNINGS OF FULL-TIME WAGE AND SALARY WORKERS	MEAN WEEKLY EARNINGS (UI WAGE REPORTS)
2001	$759	$930	$976
2005	$769	$939	$963
Absolute Change	+$10	+$9	-$13
Percent Change	+1.3%	+1.0%	-1.5%
U.S.			
2001	$656	$796	$769
2005	$653	$803	$782
Absolute Change	-$3	+$7	+13
Percent Change	-0.5%	+0.9%	+1.7%

Note: (1) The Boston CPI-U index was used to convert the nominal weekly earnings data for Massachusetts workers in 2001 into their 2005 dollar equivalents. The national CPI-U index was used to make these conversions for U.S. workers.

Sources: (i) Monthly Current Population Surveys, public use files, tabulations by authors; (ii) U.S. Bureau of Labor Statistics, Quarterly Census of Employment and Wages program, BLS web site.

They include all wages and salaries, overtime pay, bonuses, profit sharing, stock options, tips, commissions, and the cash value of any meals and lodging provided to employees.[16] By dividing the total annual payroll of employers first by the annual average number of covered workers on their payrolls and then by 52, we can obtain an estimate of average weekly earnings per employee, a mean weekly earnings estimate, which will be above the median due to skewness on the right hand tail of the wage distribution.[17] Unfortunately, the ES-202 earnings data published by the U.S. Department of Labor and the Massachusetts Department of Workforce Development cannot be used to identify the weekly earnings of any individual worker or the earnings of only full-time workers. Only mean weekly and annual earnings estimates are available from this data series.[18]

Despite fairly strong productivity growth in our state between 2001 and 2005, the average, real weekly earnings of Massachusetts workers on all three earnings measure were basically flat over this time period (Table 42 and Chart 19). Findings of the CPS household survey reveal that both median and mean real weekly earnings (adjusted for inflation) of Massachusetts' full-time wage and salary workers were essentially flat over the 2001-2005 period, rising by only 1 percent, a statistically insignificant change.[19] Our analysis of the findings of the QCEW earnings data which are based on a more comprehensive measure of labor compensation indicates a decline of 1.5 percent in real weekly earnings. The above-average loss of payroll jobs in a number of high wage sectors in the state contributed to this decline. The overall findings reveal a complete

severing of the link between labor productivity growth and real weekly earnings of Massachusetts workers between 2001 and 2005.[20]

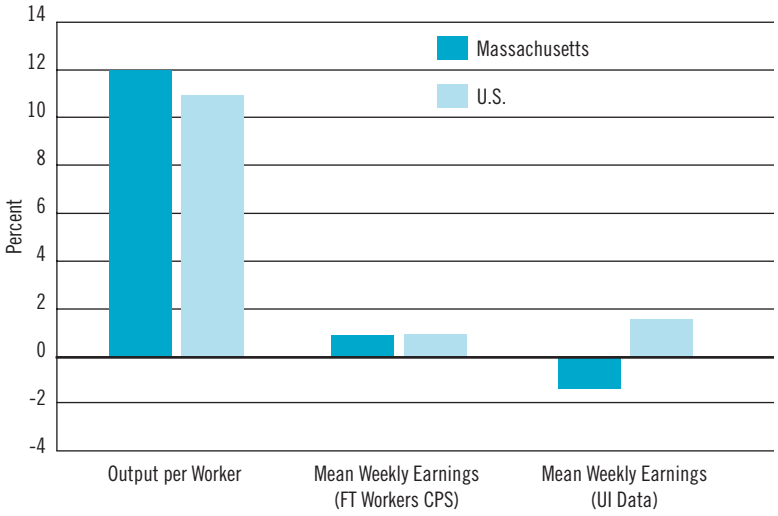
Nationally, the real wages of wage and salary workers did not fare much better with one exception. The findings of the national CPS household survey on changes in the median and mean real weekly earnings of U.S. full-time, wage and salary workers reveal no significant change in either wage measure. Neither of the estimated median and mean weekly earnings estimates from the national CPS survey was found to be statistically significant. The mean weekly earnings of U.S. workers from the QCEW survey rose by 1.7 percent between 2001 and 2005, but this rate of growth was only one- seventh the value of the estimated national growth rate in labor productivity over this four year period.

To identify the strength of the statistical links between labor productivity growth and real weekly earnings growth of U.S. and Massachusetts workers across major industrial sectors in recent years, we estimated a series of multiple regression models for the time period 2001-2004. The dependent variable in each of the models is the percent change in the real weekly earnings of wage and salary workers in the industry over the 2001-2004 period. The three independent (predictor) variables are the percent growth in labor productivity (value added per payroll worker) in the industry over the three year period, the percent change in payroll employment in the industry over the 2001-2004 period, and the percent change in the price deflator of the industry over this three year period as measured by the U.S. Bureau of Economic Analysis (Table 43).

The hypotheses underlying the construction of the model are as follows. A rise in labor productivity, *ceteris paribus*, should lead to an increase in the real weekly earnings of workers.[21]

Chart 19:

Comparisons of Estimated Percent Changes in the Mean Weekly Earnings of Full-Time Wage and Salary Workers, the Mean Weekly Earnings of All Workers Covered by the Unemployment Insurance Laws, and Real Annual Output Per Worker In Massachusetts and the U.S., 2001-2005 (in percent)



An increase in labor productivity should raise the demand for labor and boost the wage prospects of workers in the affected industry.[22] Firms that are boosting their employment levels should be more likely to raise wages than firms with stable or declining payrolls. Productivity gains brought about by downsizing and mass layoffs may not yield any wage gains to workers. Finally, the demand for workers in neoclassical labor theory is also influenced by the prices of the products or services received by the firm.[23] The higher the growth of the price deflator for the industry, the higher should be the increase in the weekly earnings of workers in the industry. Each of the three independent variables is expected to have positive impact on the changes in the real weekly earnings of workers.

Findings of the multiple regression analysis for the U.S. and Massachusetts are displayed in Table 44. Real output, employment, and weekly earnings data were available for 61 industries in

Table 43:

Definitions of the Dependent and Independent Variables Appearing in the Multiple Regression Models of the Real Wage Growth of U.S. and Massachusetts' Wage and Salary Workers, 2001-2004

VARIABLE	DEFINITION
GRWKEARN	The percent change in the mean real weekly earnings of wage and salary workers in this sector between 2001 and 2005.
EMPGROWTH	The percent change in wage and salary employment in this sector between 2001 and 2005.
PRODGROWTH	The percent change in real output per worker in this sector between 2001 and 2005.
GDPRICEGROWTH	The change in the price deflator between 2001 and 2005 for the goods and services produced by this industry.

Table 44:

The Estimated Impacts of Labor Productivity Growth, Employment Growth, and Changes in Prices of Goods/Services Produced on Real Wage Growth of Workers in Selected Private Sector Industries of the U.S. and Massachusetts, 2001-2004

VARIABLE	U.S.	MASSACHUSETTS[2]
Constant	5.70***	-.75
EMPGROWTH	.262**	.054**
PRODGROWTH	-.008	.132***
GDPRICE GROWTH	-.045	.156***
N	61	57
R squared	.195	.330
F Statistic	4.61**	8.72***

Notes: (1) *** sig. at 0.01 level. ** sig. at 0.05 level. * sig. at 0.10 level.
(2) Massachusetts results exclude the funds trust, and other financial services industry, a small financial services sector.

the U.S. The results of the regression model for the U.S. reveal that labor productivity growth had no significant effect on the growth of real weekly earnings of U.S. workers over the 2001-2004 period.[24] The estimated coefficient on the labor productivity growth variable (-.008) was close to zero and was not anywhere near significance. Real weekly wages of U.S. workers were only positively affected by the growth rate of employment in the industry. Labor productivity growth and real earnings growth in the U.S. had become completely severed over the 2001-2004 period.

Results of the regression model for Massachusetts revealed that each of the three independent variables positively and significantly influenced the growth of the real weekly wages of state workers.[25] The link between productivity growth and real wage growth for Massachusetts workers over the 2001-2004 period was positive but quite modest (Table 44). A one percent change in labor productivity, *ceteris paribus*, would be expected to raise real weekly earning by 0.13 percent. In a separate earnings model where we excluded five relatively small industries in which one or more of the variables had increased by 50 percent or more, the coefficient on the labor productivity variable had declined to 0.068 and was no longer statistically significant. The findings for Massachusetts for this latter model, thus, closely mirror those of the entire nation. With a few modest exceptions, the link between labor productivity growth and real wage growth had become completely severed in the most recent time period (2001-2004).[26] This more recent finding for Massachusetts stands in sharp contrast to that for the 1990s when there was a consistently stronger link between real weekly earnings growth and labor productivity growth in the state. Each one percent rise in labor productivity over the 1989-2000 period was associated with a 0.4 percent increase in the real weekly earnings of Massachusetts workers. Until the links between labor productivity and real weekly earnings become more fully re-established, worker living standards in the state are likely to languish.

Endnotes

1. For a review of real output developments in the entire New England region during the decade of the 1990s, see: Ishwar Khatiwada, Andrew Sum, et. al. *The Real Output Performance of the New England Economy, 1989 to 2000: Implication for Future Regional Workforce Development Policies*, Report Prepared for the U.S. Department of Labor, New England Regional Office of the Employment and Training Administration, Boston, August 2002.

2. For an example of such an analysis, *See*: Ishwar Khatiwada and Andrew Sum, *Assessing the Real Output Performance of the Rhode Island Economy, 1986-2000*, Center for Labor Market Studies, Northeastern University, Boston, 2002.

3. Knowledge of cross-state commuting patterns is important for interpreting the output and productivity performance of Massachusetts and all other New England states. Massachusetts is a net recipient of in-commuters. Findings of the 2000 Census Supplementary Survey revealed that 15.5 percent of Rhode Island workers and slightly over 15 percent of New Hampshire's workers commuted outside the state for their jobs in 2000. Only 3 percent of Massachusetts workers did so. According to the findings of the 2004 American Community Surveys, the number of working in-commuters from the other five New England states and New York exceeded the number of out-commuters from the state by slightly more than 60,000.

4. Findings on the distribution of annual earnings of workers and the incomes of families over the decade of the 1990s revealed a sharp increase in inequality in both distributions in our state, *See*: Andrew Sum, Paul Harrington, Dana Ansel, et. al., *The State of the American Dream in Massachusetts, 2002*.

5. The supply GDP approach was used in prior years by the U.S. Bureau of Labor Statistics to project future output and employment by industry and for the entire economy.

6. While a number of 14 and 15 year olds do work information on their labor force status and employment activities is not collected by either the CPS or ACS household surveys.

7. Hours of paid employment include paid vacations and paid sick leave. These means represent the experiences of all persons employed at any time during the year rather than the average monthly number of employed.

8. Total employment in Massachusetts as measured by the CPS and ACS surveys includes the self-employed, independent contractors, private household workers, and some workers in the informal economy. CPS annual estimates of resident employment between 2000 and 2004 did not decline to the same extent as payroll employment in the state. Gains in self-employment, independent contractors, off the books workers, and private household workers offset part of the payroll job decline.

9. Andrew Sum and Julio Goicoechea, *Broken Promises: Rising Labor Productivity and the Decline in the Real Weekly earnings of Production Workers Over the 1979-1989 period*, Center for Labor Market Studies, Northeastern University, Boston, 1995.

10. The findings for production and non-supervisory workers are based on the monthly payroll surveys of the U.S. Bureau of Labor Statistics also known as the Current Employment Statistics Program (CES).

11. Stock options and bonuses as a share of CEO compensation in the nation's larger corporations rose very sharply in the 1990s. *See*: (i) Brian Hall and Kevin J. Murphy, "The Trouble with Stock Options," *Journal of Economic Perspectives*, Vol. 17, Summer 2003, pp. 49-70; (ii) Carola Frydman and Raven E. Saks, *Historical Trends in Executive Compensation, 1936-2005*, Harvard University, Cambridge, Massachusetts and Federal Reserve Board of Governors, November 2005.

12. Andrew Sum, Paulo Tobar, and Joseph McLaughlin, *Who Stole Christmas: The Broken Links Between Labor Productivity Growth and the Growth of the Real Weekly Earnings of U.S. Workers from 2000 to 2006*, Center for Labor Market Studies, Northeastern University, Boston, Massachusetts, December 2006.

13. Since payroll employment in Massachusetts declined more rapidly than resident employment based on the LAUS survey, the labor productivity estimates based on the payroll employment data may be biased upward by approximately two percentage points. More of the work in the state was being performed by the self-employed, independent contractors, and off the books workers.

14. For a review of the design features of the CPS household survey and the key labor force and employment concepts and measures underlying the estimates in this survey, *See*: U.S. Bureau of Labor Statistics, *Employment and Earnings*, January 2006, "Appendix A", Washington D.C., 2006.

15. The CPS collects hourly and weekly earnings data for only one-fourth of employed wage and salary workers. *See*: U.S. Bureau of Labor Statistics, *Usual Weekly Earnings of Wage and Salary Workers: Fourth Quarter 2005*, Washington, D.C., January 2006.

16. U.S. Bureau of Labor Statistics, *Employment and Wages, Annual Averages, 1999*, Bulletin 2534, Washington D.C., February 2001.

17. The CPS weekly earnings data are also skewed to the right. The mean weekly wage estimates exceeded the medians by 20 to 23 percent. The true mean/median gap in the CPS is actually higher than this. Due to top coding of weekly earnings by the U.S. Census Bureau, the earnings of those in the top five percent of the distribution are artificially low.

18. The ES-202 earnings data are available for a wide array of private sector industries and federal, state, and local government agencies.

19. A t-test of the statistical significance of the difference between the two sample means found no statistical significance even at the 0.10 level.

20. National evidence reveals that non-wage compensation, especially health insurance costs and pension costs did rise at above average rates during this time period. Real labor compensation grew faster than the real wages of workers, but we cannot identify how much the average worker benefits from this. Many of these gains may have gone to the top earners.

21. The "ceteris paribus" expression is the Latin term for holding all other predictor variables constant when estimating the impacts of a change in the given independent variable.

22. If the demand for labor rises faster than available supply, the real wage should rise to clear the labor market in accord with conventional neoclassical wage theory.

23. For a review of the neoclassical theory of the demand for labor by a competitive firm and industry, *See*: Ronald Ehrenberg and Robert Smith, *Modern Labor Economics: Theory and Public Policy,* (Seventh Edition), Addison-Wesley, Reading, Massachusetts, 2000.

24. In an alternative model, we dropped four industries where one or more of the predictor variables exceeded 50 percent. The estimated coefficient of the labor productivity variable in this model also was close to zero and not significant.

25. The wage growth model for Massachusetts excluded the funds, trusts, and other financial vehicles industry, a small industry in which real output per worker and weekly wages were estimated to have risen by more than 100 percent over the 2001-2004 period.

26. With one exception, the excluded industries were quite small employers in the state. They were support activities for mining, computer and electronic motor manufacturing, motor vehicle and parts manufacturing, funds/trusts/and other financial vehicles.

VII. LINKS BETWEEN OUT-MIGRATION, JOBS AND HOUSING

In recent years, Massachusetts has been facing a major demographic problem that has been limiting both population and labor force growth in the state and placing constraints on future economic growth. This demographic development is the continued high level of net domestic out-migration to other states across the country.[1] Following the end of the jobs and economic boom in early 2001, net domestic out-migration from Massachusetts increased steadily and substantially over the following five years before moderating slightly in 2006.[2] Over the July 2000 to July 2006 period, 286,000 more persons left Massachusetts to move to other states than came here from other states, an extraordinarily high level of net domestic out-migration. Findings of focus groups with recent out-migrants reveal that most do not plan to return to our state.[3]

As a result of these high levels of domestic out-migration, Massachusetts has ranked among the lowest performing states in population growth and labor force growth in recent years. The overall resident population of Massachusetts is estimated to have declined in both 2003 and 2004. The annual average growth rate of the population in Massachusetts during the 2000-2006 period was only 0.2 percent. The state also experienced little growth in its resident labor force during this period. The 2006 labor force was only 1 percent higher than it was in 2000. In fact, had it not been for new foreign immigration into the state, the population and labor force of Massachusetts would have declined substantially between 2000 and 2006.

A number of alternative explanations of these high levels of out-migration from Massachusetts have been offered by demographers, economists, and media analysts, ranging from lack of job opportunities, a high cost of living, housing affordability problems and an unpleasant climate. This paper is designed to estimate the impact of job creation (loss), housing affordability and relative wages on domestic in and out-migration across states over the entire 2000-2006 period. Our analyses based on multiple regression techniques will show that net out-migration from a state can be explained in large part by changes in the availability of job opportunities and the affordability of housing in the state. The model predicts the out-migration experiences of the state over the 2000-2006 period quite well.

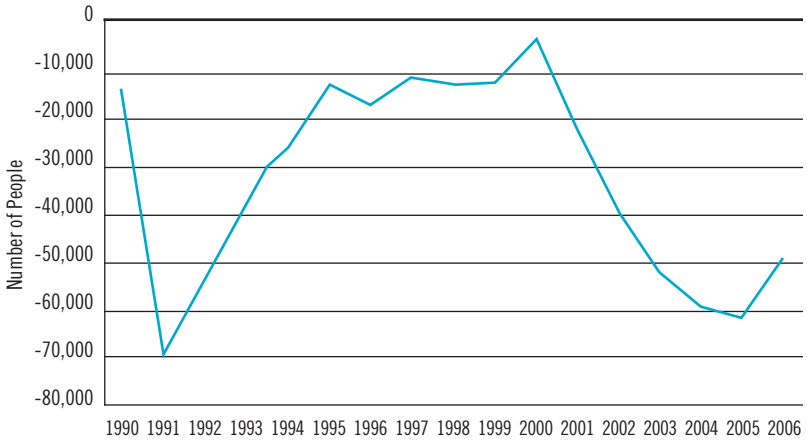
IN MASSACHUSETTS OUTMIGRATION IS CLEARLY CORRELATED WITH JOB CREATION.

Domestic Out-Migration from 1990 to 2006

In Massachusetts, out-migration from the state is clearly correlated with the performance of the state economy in generating jobs. During the strong economy of the state during the mid to late 1990s, far fewer people left the state while during the bad economic times of the early 1990s a large number of people moved out of the state. Chart 20 displays this behavior. During the early 1990s, net out-migration levels were high as the state continued to lose a large number of jobs. Between July 1990 and July 1991, nearly 70,000 more people left the state than came here from other states across the country. By the end of the 1990s, when the labor market was performing quite strongly, net domestic migration for Massachusetts was roughly in balance. Out-migration from Massachusetts to other states exceeded in-migration from other states by only 3,600 from

Chart 20:

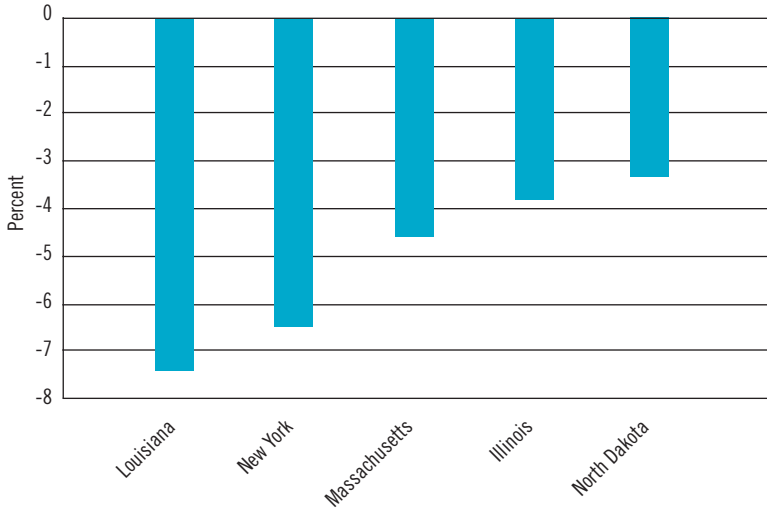
Trends in Annual Net Domestic Out-Migration in Massachusetts from 1990-2006



Source: Annual Population Estimates, U.S. Census Bureau, Population Division. CLMS Tabulations.

Chart 21:

The Five States with the Highest Levels of Net Domestic Out-Migration Between July 2000-July 2006 as a Percent of Their Resident Population in July 2000 (in percent)



July 1999 to July 2000 (Chart 20). Over the next five years, following the recession of 2001 and steep job losses in 2002 and 2003, net domestic out-migration accelerated, rising from -3,623 in 2000 to -40,740 in 2002 and to highs of approximately -60,000 in 2004 and -61,500 in 2005 before declining modestly to -49,500 in 2006.

The level of net domestic out-migration from Massachusetts to other states over this 6-year period was equal to 286,000 or 4.6 percent of the July 2000 resident population of the state. Massachusetts ranked third highest among the 50 states on this relative out-migration measure (Chart 21). Only Louisiana and New York were characterized by a net out-migration rate higher than that of Massachusetts. Louisiana's high net out-migration rate was primarily attributable to population displacement from the effects of hurricane Katrina. The Commonwealth would have ranked second highest on this population measure if Louisiana were excluded from the analysis. Furthermore, Massachusetts was the only state experiencing a loss in its overall resident population in both calendar years 2004 and 2005, and it ranked second lowest in its labor force growth rate between 2002 and 2006. Only Louisiana fared worse than Massachusetts.

Links Between Net Out-Migration and Job Losses

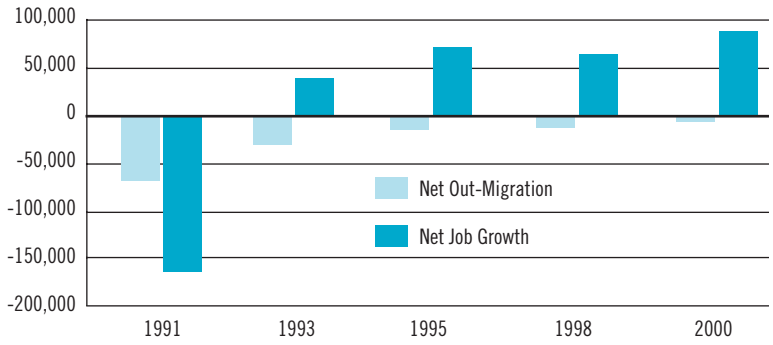
The high levels of domestic out-migration from the state appear to be strongly correlated with the high levels of job loss in Massachusetts from 2001 through early 2004. As noted earlier, aggregate wage and salary employment in Massachusetts during the first two quarters of 2006 has remained well below its peak level in the first quarter of 2001. During this time period, wage and salary employment in Massachusetts (seasonally adjusted) declined by 144,000 or 4.35 percent. These steep job losses encouraged some residents, especially younger adults with strong labor market attachment, to leave the state and discouraged residents of other states to migrate to Massachusetts.

The links between state labor market devel-

opments and net domestic out-migration were quite strong in the 1990s as well.[4] During the recessionary labor market environment of the early 1990s, the state also experienced high levels of annual domestic out-migration. Between July 1990 and July 1993, nearly 152,000 more persons left Massachusetts to relocate to other states across the country (Chart 20). As renewed job growth occurred from 1993 onward, the levels of net out-migration declined fairly steadily and strongly from 53,000 in 1992 to only 3,600 in 2000 (Chart 22).

Chart 22:

Comparisons of Wage and Salary Job Growth[1] and Net Domestic Out-Migration from Massachusetts, Selected Years, 1991 to 2000



Note: (1) Nonfarm employment.

The Model of Domestic Migration for States

For the past several years, local and national media, labor market analysts, housing analysts, other academic researchers, and policymakers have engaged in a variety of efforts aimed at exploring the links between out-migration and rising housing prices.[5] Past research on this issue has also supported the link between domestic out-migration, high home prices, and a lack of job opportunities. A study by a group of researchers at the Federal Reserve Board of Governors in Washington, D.C. in the 1980s concluded that high costs of home ownership discouraged in-migration and encouraged out-migration.[6] A study by economist Karl Case published in the New England Economic Review in 1991 found high home prices and unemployment in Massachusetts between 1980-1990 "discouraged entry into the state's labor force while higher wages encourage entry."[7] In the following section, we will explore the statistical links between domestic out-migration, job growth/loss, relative annual earnings, and housing affordability across states between 2000 and 2005. We have constructed a multivariate statistical model to identify how well domestic out-migration could be predicted based on a state's job growth/loss, relative annual wages, and housing affordability in recent years. The definitions of the variables used in the multiple regression model are listed in Table 45.

The dependent variable is the level of net domestic out-migration between July 2000 and July 2005 as a share of each state's 2000 resident population. This variable takes on both positive values when there is net in-migration and negative values when there is net out-migration. The independent variables in the model are the percent change in nonfarm wage and salary employment between 2000-2005 in the state, the relative median annual wages of full-time, year-round workers adjusted for their educational attainment, and the state's housing affordability ratio. The housing affordability ratio measures the median housing price in each state as a percent of median household income.[8] The data on payroll employment growth/decline rates for states are based on the findings of the Quarterly Census of Employment and Wages (QCEW) for states. The estimates of median relative earnings in 2005 and the housing affordability ratio for each state in 2005 are based on the findings of the 2005 American Com-

Table 45:

Definitions of Variables Used in the Multiple Regression Models Predicting Domestic Out-Migration from Massachusetts, 2000-2006

VARIABLE	DEFINITION
Dependent Variable	
OutMig_00_06	2000-2006 net out-migrants as a percent of the 2000 resident population of each state. The value of this variable takes on both positive and negative values.
Independent Variables	
Emp00_05	Percent change in wage and salary employment between 2000 and 2005 by state. The value of this variable also ranges from positive to negative values.
RLMedWage05[9]	Relative median annual wages of full-time, year-round workers by state adjusted for educational attainment.
Affordability99_05	Two year average of the housing affordability ratio in 1999 and 2005 by state.
Affordability05	The housing affordability ratio in 2005. It represents the ratio of the median housing price to median household income in a state.

munity Surveys. The affordability ratios for 2000 are based on the 2000 Census.

We estimated the following two regression models with the above data:

Model I:

$$OutMig00\_06 = a + ß1\ Emp00\_05 + ß2 RLMedWage05 + ß3 Affordability99\text{–}05$$

Model II:

$$OutMig00\_06 = a + ß1\ Emp00\_05 + ß2 RLMedWage05 + ß3 Affordability05$$

Results of the Regression Models

The results for the first regression model are presented in Table 46. The coefficients of two variables- the percent change in wage and salary employment between 2000 and 2005 by state (Emp00_05) and the simple two-year average of the 2000-2005 housing affordability ratio (Affordability99_05) were statistically significant at the 0.01 and 0.05 level, respectively. Holding everything else constant, a one percentage point increase in wage and salary employment of a state increases the net in-migration rate of the state by 0.60 percentage points. Similarly, a 1-unit increase (from 3.0 to 4.0) in the housing affordability ratio in the state would lead to a nearly 1.50 percentage point increase in the net out-migration rate of residents from the state. High housing prices, *ceteris paribus*, encourage out-migration. The coefficient of the relative median wage variable (RLMedWage05) was positive as hypothesized but not statistically significant. This model explained 42 percent of the variation in the domestic out-migration rates of states as represented by the value of the R-Squared statistic. In cross-section analyses, such as the one used in our analysis, an R-Squared of 0.42 is considered quite respectable. The overall regression model was statistically significant at the 0.01 level as represented by the F-statistic.

In the second regression model, we replaced the average housing affordability ratio for 1999-2005 by the housing affordability ratio in 2005. Regression results are presented in Table 47. The signs of the three coefficients for the independent variables remained the same. The value of the coefficient on the employment change variable remained exactly the same and was significant at the 0.01 level. The value of the housing affordability coefficient was -1.05, implying that a one unit increase in the housing affordability

ratio would lead to a 1.05 percentage point increase in the net out-migration rate of residents to other states. The relative wage variable had a positive coefficient, but it was not statistically significant. The value of the R-Squared statistic remained at 42 percent, and the overall statistical model was highly significant at the 0.001 level.

Findings of these two regression models also were used to estimate the elasticities of domestic out-migration with respect to changes in job growth rates and housing affordability ratios across states. The elasticity measure represents the expected percent change in the out-migration rate from a one percent change in either the job growth rate or the housing affordability ratio. It is a measure of relative responsiveness. Typically, these elasticity values are computed at the mean values of the variables being analyzed. In these models, however, the dependent variable is the net domestic migration ratio whose mean value is close to zero since states with positive net in-migration have to be balanced by a similar number of states with negative out-migration. As a result, we estimated the values of the two elasticity variables at the 80th percentiles of the distributions for the variables being compared. Estimated elaticities of domestic in or out-migration rates with respect to job growth rates and housing affordability ratios are displayed in Table 48.

We used the following formulas to estimate the elasticities of out-migration with respect to housing affordability and employment growth rates in regression models I and II.

$$\frac{\partial OutMig00\_06}{\partial Affordability} * \frac{Affordability\ Ratio\ at\ 80th\ Percentile}{Net\text{–}Migration\ Rate\ at\ 80th\ Percentile}$$

$$\frac{\partial OutMig00\_06}{\partial Emp00\_6} * \frac{Emp00\_06\ at\ 80th\ Percentile}{Net\text{–}Migration\ Rate\ at\ 80th\ Percentile}$$

Table 46:

Multiple Regression Results for the First Model Used to Predict the Relative Level of State Domestic Out-Migration from 2000-2006

VARIABLE	COEFFICIENT
(Constant)	0.774
	(4.67)
Emp00_05	0.602***
	(0.11)
RLMedWage05	3.250
	(5.87)
Affordability99_05	-1.455**
	(0.61)
MODEL SUMMARY	
R Square	0.420
Degrees of Freedom	47, 3
F-Statistic	11.4***

Note: *** implies significance at 0.01 level **implies significance at 0.05 level Numbers in the brackets are standard errors.

Table 47:

Multiple Regression Results for the Second Model Used to Predict State Domestic Out-Migration Rates from 2000-2006

VARIABLE	COEFFICIENT
(Constant)	-0.852
	(4.94)
Emp00_05	0.603***
	(0.11)
RLMedWage05	4.076
	(6.05)
Affordability05	-1.050**
	(0.44)
MODEL SUMMARY	
R Square	0.422
N, Degrees of Freedom	47, 3
F-Statistic	11.4***

Note: *** implies significance at 0.01 level **implies significance at 0.05 level. Numbers in the brackets are standard errors.

Table 48:

Estimated Elasticities of Net Domestic Migration Ratios with Respect to Changes in Employment and Housing Affordability Ratios Evaluated at the 80th Percentiles of Their Distributions

VARIABLE	MODEL I	MODE II
Housing Affordability Ratio	-1.92	-1.57
Employment Growth Rate	+1.27	+1.27

The elasticity of net out-migration with respect to housing affordability was characterized by a high negative value in both of the models, indicating that out-migration rates are very responsive to changes in the housing affordability ratio. The negative elasticities of approximately -1.9 and -1.6 indicate that out-migration is very responsive to increases in housing affordability. A one percent change in the housing affordability ratio will increase the out-migration rate by 1.6 to 1.9 percent. The estimated elasticity of out-migration with respect to job growth was equal to 1.27 in both models. This implies that a one percent increase in a state's employment growth rate would increase domestic in-migration by nearly 1.3 percent.

Predicting Out-Migration Rates for Massachusetts

How well did these two regression models predict the actual rates of net domestic out-migration in Massachusetts over the July 2000-July 2006 period? To answer this question, we compared the actual value of the net out-migration rate in Massachusetts with the predicted values from the two regression models. Plugging the values of the coefficients for the independent variables from the regression analyses in models I and II for Massachusetts with the values of the three explanatory variables for the state yielded the predicted value of the domestic out-migration rate in Massachusetts.

Over the 2000-2005 period, nonfarm wage and salary employment in Massachusetts declined by 3.5 percentage points. The average value of the housing affordability ratio for Massachusetts was 5.00 vs. a value of only 3.20 for the U.S. Only California and Hawaii had higher housing cost ratios than Massachusetts. Results in Table 49 reveal that both of the regression models predicted the out-migration experience of Massachusetts very well. The actual value of the domestic net out-migration rate in Massachusetts was -4.60 percent and the predicted values for the state were -4.90 percent in the first model and -4.95 percent in the second model. The differences between actual and predicted values in the first and second regression models were only 0.30 and 0.35 percentage points, respectively. Out-migration in Massachusetts over the 2000-2006 period was strongly linked to both the state's poor job creation performance and its increasingly high housing costs ratio. By 2005, the housing affordability ratio of our state had risen to 6.32, the third highest in the nation.

The high domestic out-migration rate from the state over the July 2000-July 2006 period was impacted about evenly by the poor job creation rate and the high and rising average affordability ratio. To illustrate this, assume that rather than declining by 3.5 percent the state's job creation rate between 2000 and 2005 had been equal to the national average of 1.3 percent. If this alternative scenario had occurred, the net out-migration rate of the state would have been reduced by 2.9 percentage points. The state's two year average housing affordability ratio was equal to 5.00 vs. an average of only 3.23 for the U.S. If the state's housing affordability ratio had been equal to the national average, the net out-migration rate would have declined by nearly 2.6 percentage points over

the 2000-2006 period.

Massachusetts state and local economic policymakers and the business/labor community need to pay more serious attention to the high levels of domestic out-migration that have prevailed since 2001. These out-migrants contain a high share of relatively young (22-39 year olds) and well-educated adults who would have been strongly attached to the labor market if they had remained here. Many of the out-migrants were young families with children. Their exodus from the state has reduced the number of active labor force participants, future labor force participants, and the number of adult taxpayers who would have favorably contributed to the fiscal position of both state and local governments. The loss of this potential pool of labor will constrain future job and economic growth in the state. We are losing our economic future.

Both the extremely weak job generating performance of the state over the past six years (2001-2006) and the sharp run-up in housing costs (especially home ownership costs) for new home buyers have been the major culprits underlying the high levels of out-migration of adults and families. Improved job creation in Massachusetts during 2005 and 2006 was not sufficient by itself to sharply reduce the high levels of out-migration. The high value of median home prices relative to household incomes remains a major economic barrier to retaining young families and workers and attracting well educated workers from other states. Public policymakers must focus on improving job creation, the real wages of Massachusetts workers, and the relative costs of housing if out-migration is to be substantially reduced in the years ahead. No less than the state's economic and social future is at stake.

Table 49:

Actual and Predicted Values of Domestic Out-Migration in Massachusetts from the Two Regression Models

MODEL	ACTUAL	PREDICTED	DIFFERENCE
Model I	-4.60	-4.90	+0.30
Model II	-4.60	-4.95	+0.35

Endnotes

1. For a review of out-migration developments in Massachusetts between 2000-2005 and their impact on the growth of the state's population and labor force, *See*: Andrew Sum, Ishwar Khatiwada, Joseph McLaughlin, et al, *Massachusetts Economy: The Labor Supply and Our Economic Future*, Center for Labor Market Studies and MassINC, Boston, 2006.
2. These estimates of domestic out-migration pertain to July of the prior calendar year to July of the year cited. All of these estimates of domestic out-migration are based on the state population estimates and components of change of the U.S. Census Bureau. Domestic net migration represents the difference between the number of persons who moved into Massachusetts from other states and the number of Massachusetts residents who moved to other states during a given year.
3. For an analysis of in and out-migration developments in Massachusetts and other states and their impacts on population and labor force growth, *See*: Michael Levenson, "Most Who Left State Don't Plan to Return", *Boston Sunday Globe*, May 22, 2006, PP. A-1 to A-4.
4. For analyses of domestic in and out-migration levels in Massachusetts during the decade of the 1990s, *See*: (i) Andrew Sum, Anwiti Bahuguna, Neeta Fogg, et. al., *The Road Ahead: Emerging Threats to Workers, Families, and the Massachusetts Economy*, Teresa and H. John Heinz III Foundation and MassINC, Boston, 1998; (ii). Robert Nakosteen, Michael Goodman, Dana Ansel, et. al., *Mass Migration*, Mass Housing Institute and the University of Massachusetts Donahue Institute, Boston 2003.
5. *See*: (i) Kimberly Blanton, "Home Costs Are Called a Drag on State Growth, Studies Find Population Loss, Limit to Jobs", *The Boston Globe*, May 22, 2006. (ii) Wendell Cox and Ronald D. Utt, *Housing Affordability: Smart Growth Abuses Are Creating a "Rent Belt" of Higher Rent Areas*, The Heritage Foundation, Washington, D.C., January 2007; (iii). Les Christie, "Housing Prices put American on the move", CNNMoney.com, April 20, 2006.
6. Stuart A. Gabriel, Janice Shack-Marquez, and William Wascher, *Regional Labor Markets, Cost of Living Differentials, and Migration*, Federal Reserve Board of Governors Washington, D.C., 1988.

7. Karl E. Case, "The Real Estate Cycle and the Economy: Consequences of the Massachusetts Boom of 1984-1987," *New England Economic Review*, September/October 1991.

8. The housing affordability ratio is obtained by dividing the median home price by median household income.

9. The relative median wage of full-time, year-round workers represents the attractiveness of state wages for workers to remain in that state. To estimate the value of this ratio, we first estimated median annual wages for workers in each state and the U.S. for five educational subgroups. We multiplied the ratios of median annual earnings for workers in five educational subgroups in each state to the U.S. median for the same subgroups by the national share of workers in each subgroup. The value of the wage index for state i is thus equal to the following: $\sum_{j=1}^{5} S_j \frac{W_{j,i}}{\bar{w}_j}$, where w_j, i equals the median annual earnings of educational group j in state i and $\hat{w}_j$ is the median annual earnings of all U.S. workers in educational groups. The w_j variable represents the share of national workers in educational groups j.

VII. SUMMARY OF KEY FINDINGS

This research report has provided a detailed description and analysis of payroll employment developments in Massachusetts as a whole, geographic areas of the state, and key industrial sectors over the past few decades, with a major emphasis on job developments over the 2001-2006 period. Shift-share analyses of these employment changes across the state also were undertaken, and real output and labor productivity developments during both the 1990s and the 2001-2005 period were assessed. The impacts of payroll job developments and relative housing costs on domestic in and out-migration of Massachusetts residents also were estimated with the use of multiple regression models. A summary of key findings and their implications for state economic development and workforce development policymaking is presented below.

(i) The job creation performance of Massachusetts has varied considerably over the past few decades, with a steep deterioration in the state's absolute and comparative job generation performance since early 2001. During the 1980s Miracle Decade, a time period characterized by of very strong job and real output growth, the state added more than one-half million wage and salary jobs (515,000), a near 20 percent job growth rate that matched the national average job growth rate, and the state ranked 23rd highest among the 50 states on this job growth measure. Massachusetts captured nearly 3 percent of the entire net new jobs generated by the national economy between 1979 and 1989.

(ii) The 1980s economic boom in the state ended in early 1989, and the state entered a severe economic downturn that lasted for nearly four years during which the state lost 10 percent of its wage and salary jobs. From 1992 to 2000, however, the state added 531,000 wage and salary jobs, representing a 19 percent growth rate, coming close to that of the nation (21%). This strong rate of job growth helped lower the state's unemployment rate to a post-WWII historical low rate of 2.6 percent in calendar year 2000.

(iii) Given the onset of the national recession in March 2001, wage and salary job growth in Massachusetts came to an abrupt end in the first quarter of that year. Over the next three years, the aggregate number of payroll jobs in the state declined steadily and steeply, falling by 194,400, or close to 6 percent. Massachusetts experienced the highest payroll job loss rate among the 50 states over this three year time period. The losses in payroll employment were widespread across many industrial sectors and most geographic areas of the state, with large cities and the more populous counties in eastern Massachusetts absorbing the most severe job losses.

MASSACHUSETTS EXPERIENCED THE HIGHEST JOB LOSS AMONG THE 50 STATES.

(iv) Growth in formal payroll employment was renewed in the first quarter of 2004, and it has continued fairly steadily over the past three years. Between 2004 I and 2006 IV, the state economy generated 68,000 net new wage and salary jobs. The pace of job growth, however, was not sufficiently high to restore the state back to its previous peak payroll employment level in the first quarter of 2001. In contrast to the state experience, payroll employment nationally in the fourth quarter of 2006 (seasonally adjusted) was nearly 6.4 million higher than it was during the first quarter of 2001. Massachusetts was one of

only seven states that had failed to surpass its pre-recessionary peak employment level, and it had the second worst job creation record over this six year period.

Payroll employment levels in the state in the first three months of 2007 still remained more than 110,000 below their peak historical level in the first quarter of 2001. Recently, the Patrick Administration has announced a goal of creating 100,000 net new jobs over the next four years. While achieving this job creation target would represent an improvement over our state's performance over the past four years, it would still leave aggregate payroll employment at the end of 2010 below its level at the beginning of the decade. This would be the first time in the history of the state when there was no net job creation over an entire decade.[1]

(v) Job developments tended to vary considerably across geographic areas of the state during both the time period of severe losses job losses (2001 I-II – 2004 I-II) and renewed job growth (2004 I-II – 2006 I-II). During the first time period, a few counties of the state (Barnstable, Dukes, Plymouth, and Nantucket) actually added net new payroll jobs while Essex, Middlesex, and Suffolk Counties experienced substantial job losses. The state's 18 largest cities also incurred a highly disproportionate share of the payroll job losses during this time period. About 75 percent of the state's payroll job losses were accounted for by 16 of the 18 largest cities of the state between the first half of 2001 and 2006. Since early 2004, job growth has been fairly broad based across geographic regions of the state but not all cities or counties have benefited from the recent job expansion. Barnstable, Dukes and Franklin Counties have experienced minor job losses between the first six months of 2004 and the first six months of 2006 while employment levels in both Bristol and Hampden Counties were basically stagnant. Five of the state's 18 largest cities experienced job declines during the 2004 to 2006 time period. These job losses ranged from lows of -1.7 percent in Springfield and -2.5 percent in Fitchburg to highs of -4.0 percent in Fall River and -5.1 percent in Attleboro.

THE STATE'S LARGE CITIES SUFFERED THE GREATEST JOB LOSSES.

(vi) To enhance our understanding of the economic forces driving employment developments in the state, several shift-share analyses of employment changes by industry in Massachusetts were undertaken. The findings of our shift-share analyses of employment developments for the state revealed the importance of changes in state competitiveness in key industrial sectors during the two time periods analyzed, i.e., 1992 to 2000 and from 2001 to 2006. During the first time period (1992-2000), the strong growth in payroll employment in the state was influenced by a combination of a very strong national job growth rate and a favorable mix of industries in the state. The state, however, lost job shares in a number of key industries. The negative state share effects indicate that the state lost part of its competitive advantage in key industries, especially in high technology manufacturing. The positive effect of the national job growth rate and the favorable industry mix effect more than offset the loss of jobs due to a decline in the state's share of national jobs in many industries. Had the state kept its share of national jobs in each industry sector, it would have added another 63,000 new jobs between 1992 and 2000. However, due to the loss of its competitive share in key industries, the actual number of new payroll jobs created bet-

ween 1992 and 2000 was 497,000, about 63,000 fewer jobs than the 560,000 jobs that the state would have created if it had maintained its 1992 shares of national jobs across industries.

(vii) The second time period (2001-2006) was characterized by sizable job losses in many major industrial sectors of the state. Declining shares of national employment within most major industrial sectors played the key role in generating these large payroll job losses in the state. Only in the past three years (2004-2006) has the state started to generate net new payroll jobs. Between the first six months of 2004 and the first six months of 2006, Massachusetts created around 43,500 new payroll jobs. The strong national job growth rate and favorable industry mix effects would have added about 114,000 new payroll jobs, however, the substantial and continuing loss of shares of national jobs in key industries offset the positive national growth rate and industry mix effects, particularly in the construction, manufacturing, trade, transportation, and utilities industries of the Commonwealth.

(viii) The high-tech industries were one of the major sectors that fueled the economic growth of Massachusetts in the 1980s and the 1990s. Massachusetts high-tech industry wage and salary employment growth rate was 17 percent between 1990 and 2000. The state added nearly 38,000 high-tech wage and salary jobs over this 10-year period. However, between 2001 and 2005, the high-tech industries in Massachusetts experienced a very severe loss of wage and salary employment jobs. The high-tech labor market boom ended in the Commonwealth along with the technology bust of 2000. Massachusetts lost 58,000 wage and salary jobs in high-tech industries over the 2001-2005 period, accounting for one half of the wage and salary job losses over this 4-year period. To make things worse, a high share of the high-tech jobs in Massachusetts tended to be "export-based". Job losses in high-tech industries were attributable to the restructuring of the industry, downsizing, and outsourcing of some jobs to low wage countries like China and India. High-tech job losses in recent years were not unique to Massachusetts, but prevailed across the country. The U.S. lost 1.01 million wage and salary jobs in high-tech industries over the 2001-2005 period. However, high-tech employment job losses in Massachusetts were more pronounced than they were in the entire nation. The state's competitive advantage in this sector declined sharply over the past five to six years.

THE STATE HAS LOST ITS COMPETITIVE POSITION IN SEVERAL KEY INDUSTRIES.

(ix) The Massachusetts biotech industry is believed by some economic analysts to be one of the most promising industries. This particular industry has future economic potential given the state's highly supportive infrastructure, including research and development labs, excellent universities, a continuous flow of venture capital, and a well educated workforce. Recent employment trends in biotech industries of Massachusetts have exhibited a rising trend over the past 15 years. The biotech sector generated nearly 22,000 new wage and salary jobs between 1990 and 2005. Within the four biotech industries, three were characterized by increasing employment over this 15-year period. The biotech industry in Massachusetts continued to add new wage and salary jobs even after the recession of 2001 when most other sectors experienced job losses. During the 1990s and the first half decade of the current decade, wage and salary employment growth in Massachusetts' biotech industries out-

paced that of the entire nation by a fairly large margin. More than half of the jobs in biotech industries were categorized as "export-based". In 2005, nearly 37,000 jobs in biotech industries of Massachusetts were "export-based".

(x) Knowledge of job vacancy developments by industry and occupation is helpful in identifying job clusters where employers are attempting to fill existing jobs. Workforce development programs aimed at more efficiently filling such job openings could help boost employment levels in the state and reduce unemployment. Job vacancies in the state have steadily increased since the fourth quarter of 2002 when the Massachusetts Division of Unemployment Assistance initiated the Job Vacancy Survey. In the fourth quarter of 2002, the first job vacancy survey yielded just under 50,000 job openings across the state, representing a job vacancy rate of 1.7 percent.[2] Over the next three years, the estimated number of job vacancies consistently increased, reaching nearly 75,000 job vacancies in the fourth quarter of 2005 and nearly 85,000 vacancies in the first half of 2006. The Massachusetts job vacancy rate increased from 1.7 percent in the fourth quarter of 2002 to 2.6 percent in the fourth quarter of 2005, the highest it has been over the 2002-2005 time period. Job vacancies and job vacancy rates have varied quite considerably across industrial sectors of the state. In 2005, the largest number of job vacancies was registered in the healthcare industry sector with an average of 15,989 job vacancies, representing a 3.8 percent job vacancy rate, followed by the retail trade sector with 11,035 job vacancies (a 3.3% vacancy rate), the professional and technical services sector with 7,017 vacancies (3.7%), and the accommodation and food services sector with 6,821 job openings (3.0%). These four industrial sectors combined accounted for more than half of the total number of vacancies prevailing in the state during 2005.

(xi) Estimates of employment changes in Massachusetts presented in the report were primarily based on the findings of the CES employment survey, but they also can be compared to the findings on employment changes from the LAUS household survey. There were a number of important differences in the estimates of employment change from these two surveys. From the first quarter of calendar year 2001 through the first quarter of 2004, nonfarm wage and salary employment in the state declined by nearly 194,000 or 6 percent according to the findings of the CES payroll survey. While the LAUS household survey also indicates that employment of state residents declined over this three year period, the estimated magnitude of the decline in resident employment from the LAUS survey was considerably smaller (-85,000). The difference between these two surveys' estimates of state employment decline over this three year period was an extraordinarily large 109,000. Since the first quarter of 2004, however, employment in the CES survey has increased at a faster pace than the estimates from the LAUS survey, partially closing the gap between their estimates of employment change between 2001 and 2006.

A number of structural changes in Massachusetts labor markets are the likely cause of the conflicting employment findings between the two surveys. The gap between the CES and LAUS estimates of employment change from 2001 to 2004 was due to increases in self employment, independent contractor employment, and persons working off the books. Many of the workers in these types of employment arrangements will report that they are working when interviewed for the CPS household survey, but they will not be captured on the CES survey since they will not appear on the formal payrolls of firms in the

state. As a result, during economic downturns, employment estimates based on the CES will decline more steeply than LAUS employment estimates since the LAUS data will capture more of these informal work arrangements. The opposite may well occur during more prosperous times as some of these independent contractors and self-employed individuals become employed as formal wage and salary workers and multiple job holding rises. The CES survey will find stronger employment growth than the LAUS employment estimates. The discrepancies in the employment changes measured by these two surveys have a number of significant implications for state policymakers. A better understanding of the economic and labor market consequences of the adoption of informal work arrangements is needed. The state loses unemployment insurance and workers' compensation tax revenues when employees are misclassified by employers as independent contractors or when workers are paid off the books, and the breakdown in labor law compliance will reduce union-related employment and jobs for native born young workers. Many legal immigrants also are net losers from the hiring of illegal immigrants in the state.

(xii) Real output growth in the state during the 1980s decade was very strong, boosted by a combination of substantial gains in payroll employment (22%) and very high growth in labor productivity. Real output per hour of paid employment is estimated to have risen by 33 percent between 1979-1989, the best performance among the 50 states. These high productivity gains and strong labor market conditions helped substantively increase both median real annual earnings of workers and median family incomes in our state over the 1980s. This would be the last time period characterized by broad based prosperity in the Commonwealth. Labor productivity growth in Massachusetts as measured by real output per worker also remained high in the 1990s. Output per worker rose by 24 percent between 1989-1999 in our state vs. only 14 percent in the nation as a whole, and Massachusetts ranked fifth highest on this productivity measure. Despite these strong gains in labor productivity, only workers with a bachelor's or higher degree obtained increases in their real median earnings over the decade and the distribution of annual earnings became substantially more unequal.

(xiii) Real output of the Massachusetts economy grew far more slowly in 2001-2005 than it did in the past few decades, and real output growth rate lagged far behind the rest of the country (12.2% vs. 7.5%). Yet, labor productivity in the state as measured by output per payroll worker continued to grow and slightly outpaced that for the U.S. Yet, despite these strong gains in labor productivity, the real weekly earnings of Massachusetts workers over the 2001-2005 period were estimated to have ranged from +1.0 percent to –1.5 percent from alternative wage surveys, a finding of basic real wage stagnation. The delinking of productivity gains from real wage gains at the national and state level for workers in most industries represents a major structural shift in the labor market reward system.[3] The state's less educated workers in particular have been adversely affected by these developments, leading to rising earnings and family income inequality.

THE STATE'S COMPETITIVE ADVANTAGE IN BIOTECH HAS INCREASED.

(xiv) The weak job creation performance of the Massachusetts economy over the past six years has had a number of adverse demographic, labor force, economic, and fiscal consequences for the

state. Job declines in 2001-2003 and below-average job creation in 2004-2005 contributed significantly to high levels of net out-migration to other states, reducing population and labor force growth in the state. The loss of many relatively young, well-educated adults with a strong labor market attachment has reduced both the quantity and quality of the state's labor force and may threaten future economic and job growth. The poor job creation performance also has had adverse effects on real wage and salary job growth of workers in the state, sharply reduced employment opportunities for teens and young adults, especially those without four year degrees, and lowered the growth of state and federal tax receipts in the Commonwealth. There is a substantial number of labor market, output, fiscal, and social benefits that can be generated from higher future levels of job creation in the state. The economic future of the state will be dependent on the Commonwealth's ability to generate both a higher rate of job growth and a more diversified set of jobs that can restore the state's export competitiveness and generate employment opportunities in other industries via the job creation multiplier.

Endnotes

1. The historical data series on payroll employment levels dates back to the late 1930s. The decennial censuses for prior decades collected information on gainful employment of working-age persons.
2. The first few surveys did not obtain information on job vacancies in the public sector.
3. Nationally, key segments of the financial sector, especially Wall Street firms and their affiliates, obtained extraordinarily large bonuses and executive compensation packages. *See*: Andrew Sum, Joseph McLaughlin, and Paulo Tobar, *Who Stole Christmas from America's Front Line Workers*, Center for Labor Market Studies, Northeastern University, Boston, 2006.

APPENDIX A: DETAILED INDUSTRY SHIFT-SHARE ANALYSIS

Table A-1:

Shift-share Analysis of Changes in Massachusetts Wage and Salary Employment by 4-Digit SIC Industries, 1992-2000

SIC	INDUSTRY	1992	2000	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
	Total private	**2,368,815**	**2,866,164**	**497,349**	**21.0**	**549,017**	**11,217**	**-62,885**
	Agriculture Forestry and fishing	16,342	24,048	7,706	47.2	3,788	1,004	2,915
	Mining	1,174	1,369	195	16.6	272	-455	378
	Construction	72,566	130,110	57,544	79.3	16,819	18,630	22,095
152	Residential building construction	9,732	17,886	8,154	83.8	2,256	2,965	2,934
154	Nonresidential building construction	6,799	10,142	3,343	49.2	1,576	244	1,523
1611	Highway and street construction	2,740	6,668	3,928	143.4	635	306	2,987
1731	Electrical work	11,420	20,738	9,318	81.6	2,647	5,814	857
1742	Plastering, drywall, an insulation	2,316	4,890	2,574	111.1	537	728	1,309
1751	Carpentry work	2,309	5,297	2,988	129.4	535	1,469	984
1794	Excavation work	2,907	5,494	2,587	89.0	674	1,493	420
1799	Special trade contractors, nec	3,917	5,755	1,838	46.9	908	680	250
	Manufacturing	464,595	436,126	-28,469	-6.1	107,679	-98,552	-37,595
2711	Newspapers	14,275	13,668	-607	-4.3	3,308	-3,598	-317
2721	Periodicals	4,075	6,670	2,595	63.7	944	-175	1,825
2731	Book publishing	4,532	5,208	676	14.9	1,050	-759	385
2741	Miscellaneous publishing	2,917	5,080	2,163	74.2	676	-107	1,594
2752	Commercial printing, lithographic	7,742	8,362	620	8.0	1,794	-1,324	150
2834	Pharmaceutical preparations	2,340	4,137	1,797	76.8	542	-174	1,428
3444	Sheet metal work	2,410	4,176	1,766	73.3	559	425	782
3571	Electronic computers	32,750	11,726	-21,024	-64.2	7,590	-13,811	-14,803
3661	Telephone and telegraph apparatus	13,281	11,874	-1,407	-10.6	3,078	-1,145	-3,340
3672	Printed circuit boards	4,257	5,642	1,385	32.5	987	1,182	-783
3674	Semiconductors and related devices	11,332	10,867	-465	-4.1	2,626	1,159	-4,251
3679	Electronic components	6,142	7,719	1,577	25.7	1,424	276	-122
3823	Process control instruments	7,096	6,495	-601	-8.5	1,645	-441	-1,805
3825	Instruments to measure electricity	4,014	4,592	578	14.4	930	-1,303	951
3826	Analytical instruments	5,331	5,315	-16	-0.3	1,236	-267	-985
3841	Surgical and medical instruments	9,193	9,912	719	7.8	2,131	-1,873	461
	Transportation and Public Utilities	118,111	141,089	22,978	19.5	27,374	1,784	-6,181
4119	Local passenger transportation, nec	4,431	8,941	4,510	101.8	1,027	1,660	1,823
4213	Trucking, except local	4,375	6,105	1,730	39.5	1,014	-99	815
4513	Air courier services	2,325	12,355	10,030	431.4	539	9,384	107
4724	Travel agencies	5,402	5,610	208	3.9	1,252	-451	-593
4813	Telephone communications, except radio	19,731	18,180	-1,551	-7.9	4,573	-1,857	-4,267
4841	Cable and other pay TV services	3,637	6,758	3,121	85.8	843	1,525	753
4911	Electric services	12,636	9,035	-3,601	-28.5	2,929	-5,147	-1,382
	Wholesale trade	155,720	177,648	21,928	14.1	36,091	-11,749	-2,414

Table A-1 continued

SIC	INDUSTRY	1992	2000	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
5013	Motor vehicle supplies and new parts	5,161	5,246	85	1.6	1,196	-857	-254
5031	Lumber, plywood, and millwork	2,828	4,046	1,218	43.1	655	284	278
5044	Office equipment	3,855	4,202	347	9.0	893	-725	179
5045	Computers, peripherals, and software	16,958	19,781	2,823	16.6	3,930	2,344	-3,451
5047	Medical and hospital equipment	5,484	6,529	1,045	19.1	1,271	508	-734
5063	Electrical apparatus and equipment	4,919	6,113	1,194	24.3	1,140	-41	95
5065	Electronic parts and equipment	8,238	14,524	6,286	76.3	1,909	1,625	2,752
5074	Plumbing and hydronic heating supplies	3,558	4,058	500	14.1	825	-377	52
5084	Industrial machinery and equipment	6,494	7,913	1,419	21.9	1,505	-633	547
5122	Drugs, proprietaries and sundries	4,969	7,685	2,716	54.7	1,152	519	1,045
5141	Groceries, general line	7,111	8,003	892	12.5	1,648	-879	123
5149	Groceries and related products, nec	6,074	6,485	411	6.8	1,408	-70	-927
	Retail trade	486,312	571,275	84,963	17.5	112,712	-14,871	-12,878
5211	Lumber and other building materials	9,215	13,376	4,161	45.2	2,136	2,199	-174
5251	Hardware stores	4,016	4,352	336	8.4	931	-514	-81
5311	Department stores	37,922	42,358	4,436	11.7	8,789	-95	-4,258
5411	Grocery stores	75,977	81,808	5,831	7.7	17,609	-11,934	156
5461	Retail bakeries	6,795	7,677	882	13.0	1,575	-170	-523
5511	New and used car dealers	17,813	23,810	5,997	33.7	4,128	729	1,139
5531	Auto and home supply stores	5,266	5,824	558	10.6	1,220	-92	-571
5541	Gasoline service stations	12,666	11,727	-939	-7.4	2,936	-2,179	-1,696
5621	Women's clothing stores	12,754	10,147	-2,607	-20.4	2,956	-6,163	600
5651	Family clothing stores	12,757	18,562	5,805	45.5	2,957	3,419	-571
5661	Shoe stores	5,218	5,069	-149	-2.9	1,209	-1,505	147
5712	Furniture stores	4,589	7,443	2,854	62.2	1,064	86	1,705
5719	Miscellaneous home furnishing stores	2,607	4,744	2,137	82.0	604	1,350	183
581	Eating and drinking places	163,041	199,955	36,914	22.6	37,788	-142	-732
5912	Drug stores and proprietary stores	17,736	21,413	3,677	20.7	4,111	-2,080	1,646
5921	Liquor stores	8,281	8,113	-168	-2.0	1,919	-1,962	-125
5941	Sporting goods and bicycle shops	3,968	5,444	1,476	37.2	920	312	244
5942	Book stores	3,367	4,844	1,477	43.9	780	930	-233
5943	Stationary stores	3,202	5,636	2,434	76.0	742	936	756
5945	Hobby, toy, and game shops	3,129	4,124	995	31.8	725	651	-381
5947	Gift, novelty, and souvenir shops	5,760	7,531	1,771	30.7	1,335	779	-343
5961	Catalog and mail order houses	1,962	7,507	5,545	282.6	455	812	4,278
5983	Fuel oil dealers	5,374	5,341	-33	-0.6	1,246	-1,836	558
5999	Miscellaneous retail stores, nec	5,333	7,937	2,604	48.8	1,236	1,098	270
	Finance, insurance, and real estate	193,179	224,065	30,886	16.0	44,773	-15,647	1,760
6022	State commercial banks	22,154	20,529	-1,625	-7.3	5,135	-6,498	-262
6036	Savings institutions, except federal	17,555	16,725	-830	-4.7	4,069	-9,694	4,795
6162	Mortgage bankers and correspondents	3,060	4,396	1,336	43.7	709	1,089	-462
6211	Security brokers and dealers	17,400	36,627	19,227	110.5	4,033	7,631	7,563
6282	Investment advice	6,411	11,441	5,030	78.5	1,486	7,941	-4,397

Table A-1 continued

SIC	INDUSTRY	1992	2000	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
6311	Life insurance	27,551	19,783	-7,768	-28.2	6,385	-12,207	-1,946
6324	Hospital and medical service plans	5,375	7,069	1,694	31.5	1,246	1,276	-827
6331	Fire, marine, and casualty insurance	15,766	14,098	-1,668	-10.6	3,654	-3,739	-1,583
6411	Insurance agent, brokers, and service	20,281	20,359	78	0.4	4,700	-1,513	-3,110
651	Real estate operators and lessors	7,737	9,401	1,664	21.5	1,793	-1,223	1,094
6531	Real estate agents and managers	16,884	20,416	3,532	20.9	3,913	802	-1,183
	Services	860,816	1,160,434	299,618	34.8	199,510	131,073	-30,965
7011	Hotels and motels	29,686	34,404	4,718	15.9	6,880	-1,105	-1,057
7216	Dry cleaning plants, except rug	4,493	4,042	-451	-10.0	1,041	-974	-518
7231	Beauty shops	11,638	14,558	2,920	25.1	2,697	-1,421	1,644
7311	Advertising agencies	3,889	5,810	1,921	49.4	901	331	689
7331	Direct mail advertising services	2,130	4,384	2,254	105.8	494	7	1,753
7349	Building maintenance services	22,756	30,943	8,187	36.0	5,274	622	2,291
7361	Employment agencies	6,013	12,215	6,202	103.1	1,394	3,071	1,737
7363	Help supply services	30,779	69,504	38,725	125.8	7,134	36,396	-4,804
7371	Computer programming services	5,281	18,299	13,018	246.5	1,224	10,404	1,390
7372	Prepackaged software	9,444	24,936	15,492	164.0	2,189	9,602	3,701
7373	Computer integrated systems design	8,635	17,181	8,546	99.0	2,001	8,340	-1,795
7374	Data processing and preparation	8,158	8,625	467	5.7	1,891	1,039	-2,463
7375	Information retrieval services	544	12,371	11,827	2174.1	126	2,540	9,161
7379	Computer related services, nec	4,538	21,900	17,362	382.6	1,052	13,026	3,284
7381	Detective and armored car services	11,393	14,146	2,753	24.2	2,641	468	-356
7389	Business services, nec	11,032	12,469	1,437	13.0	2,557	3,855	-4,975
7532	Top and body repair and paint shops	4,059	5,999	1,940	47.8	941	561	439
7538	General automotive repair shops	4,255	6,699	2,444	57.4	986	950	508
7841	Video tape rental	3,295	4,327	1,032	31.3	764	195	73
7991	Physical fitness facilities	4,159	7,778	3,619	87.0	964	2,095	560
7997	Membership sports and recreation clubs	7,026	8,793	1,767	25.1	1,628	-91	230
7999	Amusement and recreation, nec	3,496	5,695	2,199	62.9	810	2,501	-1,113
8011	Offices and clinics of medical doctors	42,697	52,202	9,505	22.3	9,896	3,979	-4,370
8021	Offices and clinics o dentists	14,692	18,240	3,548	24.1	3,405	528	-386
8049	Offices of health practitioners, nec	3,333	6,422	3,089	92.7	772	815	1,501
8051	Skilled nursing care facilities	34,346	45,066	10,720	31.2	7,960	378	2,381
8052	Intermediate care facilities	12,671	8,404	-4,267	-33.7	2,937	-3,606	-3,597
8059	Nursing and personal care, nec	12,570	8,844	-3,726	-29.6	2,913	-2,809	-3,831
8062	General medical and surgical hospitals	116,491	123,881	7,390	6.3	26,999	-18,208	-1,401
8069	Specialty hospitals, except psychiatric	13,962	15,304	1,342	9.6	3,236	-1,163	-731
8082	Home health care services	16,092	20,585	4,493	27.9	3,730	5,823	-5,060
8093	Specialty outpatient clinics	6,991	11,307	4,316	61.7	1,620	373	2,322
8111	Legal services	27,133	29,851	2,718	10.0	6,289	-3,496	-75
8211	Elementary and secondary schools	14,149	18,943	4,794	33.9	3,279	2,405	-891
8221	Colleges and universities	66,709	76,902	10,193	15.3	15,461	-5,147	-122
8299	Schools and educational services, nec	5,639	7,748	2,109	37.4	1,307	3,330	-2,528

Table A-1 continued

SIC	INDUSTRY	1992	2000	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
8322	Individual and family services	25,693	27,779	2,086	8.1	5,955	7,516	-11,385
8331	Job training and related services	7,198	8,400	1,202	16.7	1,668	700	-1,167
8351	Child care services	11,363	22,053	10,690	94.1	2,634	3,867	4,189
8361	Residential care	15,278	24,777	9,499	62.2	3,541	4,239	1,719
8399	Social services, nec	7,064	6,196	-868	-12.3	1,637	-802	-1,703
8412	Museums and art galleries	3,831	4,274	443	11.6	888	787	-1,232
8641	Civic and social associations	12,697	16,958	4,261	33.6	2,943	35	1,283
8712	Architectural services	5,939	8,508	2,569	43.3	1,376	2,313	-1,120
8721	Accounting, auditing, and bookkeeping	15,545	18,004	2,459	15.8	3,603	1,497	-2,641
8731	Commercial physical research	10,799	10,330	-469	-4.3	2,503	-2,418	-554
8733	Noncommercial research organization	10,533	10,311	-222	-2.1	2,441	-1,435	-1,228
8741	Management services	11,901	10,850	-1,051	-8.8	2,758	680	-4,490
8742	Management consulting services	13,866	25,526	11,660	84.1	3,214	10,328	-1,882
8748	Business consulting, nec	1,927	5,072	3,145	163.2	447	1,799	900
8811	Private households	3,303	14,483	11,180	338.5	766	626	9,788

Table A-2:

Shift-share Analysis of Changes in Massachusetts Wage and Salary Employment by 4-Digit NAICS Industries, 2001 I-II – 2004 I-II

NAICS INDUSTRY	2001	2004	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
Total, all industries	**2,865,933**	**2,707,956**	**-157,977**	**-5.5**	**-55,115**	**16,921**	**-119,783**
Agriculture, forestry, fishing and hunting	**5,867**	**6,193**	**326**	**5.6**	**-113**	**115**	**324**
NAICS 111 Crop production	2,818	2,775	-43	-1.5	-54	44	-33
NAICS 112 Animal production	527	551	24	4.5	-10	29	5
NAICS 113 Forestry and logging	92	118	26	28.5	-2	-5	32
NAICS 114 Fishing, hunting and trapping	1,404	1,603	199	14.1	-27	-188	413
NAICS 115 Agriculture and forestry support activities	1,026	1,147	121	11.8	-20	27	113
Mining	**1,334**	**1,711**	**377**	**28.3**	**-26**	**-22**	**425**
NAICS 212 Mining, except oil and gas	1,304	1,603	299	23.0	-25	-80	405
Utilities	**11,858**	**10,199**	**-1,659**	**-14.0**	**-228**	**-460**	**-971**
NAICS 221 Utilities	11,858	10,199	-1,659	-14.0	-228	-460	-971
Construction	**132,802**	**131,662**	**-1,140**	**-0.9**	**-2,554**	**3,744**	**-2,330**
NAICS 236 Construction of buildings	28,654	30,409	1,756	6.1	-551	1,088	1,219
NAICS 237 Heavy and civil engineering construction	16,689	12,386	-4,303	-25.8	-321	-707	-3,275
NAICS 238 Specialty trade contractors	87,460	88,867	1,407	1.6	-1,682	3,491	-401
Manufacturing	**401,342**	**313,627**	**-87,715**	**-21.9**	**-7,718**	**-52,775**	**-27,222**
NAICS 311 Food manufacturing	22,872	22,478	-394	-1.7	-440	-452	498
NAICS 312 Beverage and tobacco product manufacturing	3,110	2,690	-420	-13.5	-60	-132	-228
NAICS 313 Textile mills	11,748	9,102	-2,646	-22.5	-226	-3,346	925
NAICS 314 Textile product mills	3,666	2,878	-788	-21.5	-71	-453	-265

Table A-2 continued:

NAICS INDUSTRY	2001	2004	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
NAICS 315 Apparel manufacturing	6,561	4,220	-2,341	-35.7	-126	-2,183	-32
NAICS 316 Leather and allied product manufacturing	2,422	2,010	-413	-17.0	-47	-704	338
NAICS 321 Wood product manufacturing	3,304	3,410	106	3.2	-64	-138	307
NAICS 322 Paper manufacturing	18,030	14,167	-3,863	-21.4	-347	-2,451	-1,065
NAICS 323 Printing and related support activities	20,240	16,457	-3,782	-18.7	-389	-2,747	-647
NAICS 324 Petroleum and coal products manufacturing	1,092	1,150	58	5.3	-21	-61	140
NAICS 325 Chemical manufacturing	18,077	16,321	-1,756	-9.7	-348	-1,147	-261
NAICS 326 Plastics and rubber products manufacturing	21,404	16,600	-4,804	-22.4	-412	-2,179	-2,213
NAICS 327 Nonmetallic mineral product manufacturing	8,324	6,488	-1,836	-22.1	-160	-681	-995
NAICS 331 Primary metal manufacturing	7,660	5,630	-2,031	-26.5	-147	-1,492	-392
NAICS 332 Fabricated metal product manufacturing	44,649	36,203	-8,446	-18.9	-859	-5,333	-2,254
NAICS 333 Machinery manufacturing	31,901	21,809	-10,092	-31.6	-613	-5,679	-3,800
NAICS 334 Computer and electronic product manufacturing	105,484	74,311	-31,174	-29.6	-2,029	-27,415	-1,730
NAICS 335 Electrical equipment and appliance mfg.	16,720	11,362	-5,358	-32.0	-322	-3,428	-1,609
NAICS 336 Transportation equipment manufacturing	16,224	14,280	-1,943	-12.0	-312	-1,316	-315
NAICS 337 Furniture and related product manufacturing	6,727	5,794	-933	-13.9	-129	-800	-4
NAICS 339 Miscellaneous manufacturing	31,127	26,269	-4,858	-15.6	-599	-2,428	-1,831
Wholesale trade	**142,077**	**134,779**	**-7,298**	**-5.1**	**-2,732**	**-1,188**	**-3,377**
NAICS 423 Merchant wholesalers, durable goods	74,067	63,522	-10,545	-14.2	-1,424	-3,724	-5,396
NAICS 424 Merchant wholesalers, nondurable goods	46,403	46,978	574	1.2	-892	298	1,168
NAICS 425 Electronic markets and agents and brokers	21,607	24,280	2,673	12.4	-416	3,472	-384
Retail trade	**355,251**	**349,897**	**-5,354**	**-1.5**	**-6,832**	**1,046**	**432**
NAICS 441 Motor vehicle and parts dealers	36,317	38,799	2,482	6.8	-698	1,631	1,549
NAICS 442 Furniture and home furnishings stores	12,510	12,939	429	3.4	-241	588	82
NAICS 443 Electronics and appliance stores	13,326	12,152	-1,174	-8.8	-256	-961	44
NAICS 444 Building material and garden supply stores	25,140	27,262	2,122	8.4	-483	2,296	310
NAICS 445 Food and beverage stores	91,159	88,643	-2,516	-2.8	-1,753	-2,255	1,492
NAICS 446 Health and personal care stores	26,287	26,566	279	1.1	-506	508	276
NAICS 447 Gasoline stations	12,718	12,349	-369	-2.9	-245	-422	298
NAICS 448 Clothing and clothing accessories stores	38,567	37,920	-647	-1.7	-742	1,202	-1,107
NAICS 451 Sporting goods, hobby, book and music stores	19,116	17,356	-1,760	-9.2	-368	-800	-593
NAICS 452 General merchandise stores	41,742	41,863	120	0.3	-803	915	8
NAICS 453 Miscellaneous store retailers	24,456	22,265	-2,192	-9.0	-470	-1,616	-105
NAICS 454 Non store retailers	13,913	11,786	-2,127	-15.3	-268	-1,466	-393
Transportation and warehousing	**78,533**	**70,029**	**-8,504**	**-10.8**	**-1,510**	**-2,268**	**-4,725**
NAICS 481 Air transportation	12,056	9,058	-2,998	-24.9	-232	-1,957	-809
NAICS 483 Water transportation	812	870	58	7.1	-16	39	35
NAICS 484 Truck transportation	17,190	15,944	-1,246	-7.2	-331	-410	-505
NAICS 485 Transit and ground passenger transportation	18,069	17,729	-340	-1.9	-347	554	-547
NAICS 486 Pipeline transportation	77	119	42	54.9	-1	-11	54
NAICS 487 Scenic and sightseeing transportation	921	905	-16	-1.7	-18	-136	138
NAICS 488 Support activities for transportation	6,668	5,873	-795	-11.9	-128	-29	-638
NAICS 492 Couriers and messengers	12,866	11,736	-1,130	-8.8	-247	-711	-171

Table A-2 continued:

NAICS INDUSTRY	2001	2004	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
NAICS 493 Warehousing and storage	9,875	7,789	-2,086	-21.1	-190	864	-2,760
Information	**115,062**	**87,036**	**-28,026**	**-24.4**	**-2,213**	**-15,183**	**-10,630**
NAICS 511 Publishing industries, except Internet	51,550	40,757	-10,793	-20.9	-991	-5,222	-4,580
NAICS 512 Motion picture and sound recording industries	5,830	4,857	-973	-16.7	-112	183	-1,044
NAICS 515 Broadcasting, except Internet	6,649	5,926	-723	-10.9	-128	-278	-317
NAICS 516 Internet publishing and broadcasting	4,397	2,384	-2,013	-45.8	-85	-1,633	-295
NAICS 517 Telecommunications	29,577	22,080	-7,497	-25.3	-569	-5,635	-1,293
NAICS 518 ISPs, search portals, and data processing	15,949	9,774	-6,175	-38.7	-307	-3,539	-2,329
NAICS 519 Other information services	1,111	1,258	148	13.3	-21	107	62
Finance and insurance	**182,715**	**172,720**	**-9,996**	**-5.5**	**-3,514**	**9,037**	**-15,519**
NAICS 522 Credit intermediation and related activities	60,204	62,269	2,065	3.4	-1,158	6,525	-3,302
NAICS 523 Securities, commodity contracts, investments	54,877	45,570	-9,308	-17.0	-1,055	-4,350	-3,903
NAICS 524 Insurance carriers and related activities	63,891	61,505	-2,386	-3.7	-1,229	2,043	-3,200
Real estate and rental and leasing	44,345	43,837	-508	-1.1	-853	1,457	-1,112
NAICS 531 Real estate	29,316	30,097	781	2.7	-564	2,044	-700
NAICS 532 Rental and leasing services	14,651	13,306	-1,345	-9.2	-282	-497	-567
NAICS 533 Lessors of non financial intangible assets	377	434	57	15.1	-7	-39	103
Professional and technical services	**249,217**	**221,912**	**-27,304**	**-11.0**	**-4,793**	**-3,735**	**-18,777**
NAICS 541 Professional and technical services	249,217	221,912	-27,304	-11.0	-4,793	-3,735	-18,777
Management of companies and enterprises	**73,330**	**64,196**	**-9,134**	**-12.5**	**-1,410**	**-77**	**-7,647**
NAICS 551 Management of companies and enterprises	73,330	64,196	-9,134	-12.5	-1,410	-77	-7,647
Administrative and waste services	**171,045**	**156,136**	**-14,909**	**-8.7**	**-3,289**	**414**	**-12,033**
NAICS 561 Administrative and support services	162,968	147,435	-15,533	-9.5	-3,134	81	-12,480
NAICS 562 Waste management and remediation services	8,077	8,701	624	7.7	-155	389	390
Educational services	**111,056**	**117,460**	**6,404**	**5.8**	**-2,136**	**14,237**	**-5,698**
NAICS 611 Educational services	111,056	117,460	6,404	5.8	-2,136	14,237	-5,698
Health care and social assistance	**406,981**	**429,186**	**22,205**	**5.5**	**-7,827**	**41,928**	**-11,896**
NAICS 621 Ambulatory health care services	120,555	122,972	2,417	2.0	-2,318	15,695	-10,960
NAICS 622 Hospitals	140,688	155,822	15,134	10.8	-2,706	11,728	6,111
NAICS 623 Nursing and residential care facilities	86,936	89,537	2,601	3.0	-1,672	7,178	-2,905
NAICS 624 Social assistance	58,802	60,856	2,055	3.5	-1,131	6,457	-3,272
Arts, entertainment, and recreation	**38,960**	**43,336**	**4,376**	**11.2**	**-749**	**1,980**	**3,145**
NAICS 711 Performing arts and spectator sports	7,224	7,762	539	7.5	-139	132	545
NAICS 712 Museums, historical sites, zoos, and parks	4,906	4,936	30	0.6	-94	192	-68
NAICS 713 Amusements, gambling, and recreation	26,830	30,638	3,808	14.2	-516	1,649	2,675
Accommodation and food services	**232,951**	**237,215**	**4,264**	**1.8**	**-4,480**	**14,331**	**-5,587**
NAICS 721 Accommodation	34,850	31,026	-3,824	-11.0	-670	-849	-2,305
NAICS 722 Food services and drinking places	198,101	206,188	8,087	4.1	-3,810	15,981	-4,084
Other services, except public administration	**111,209**	**116,825**	**5,616**	**5.0**	**-2,139**	**4,339**	**3,416**
NAICS 811 Repair and maintenance	27,812	27,116	-696	-2.5	-535	-105	-56
NAICS 812 Personal and laundry services	35,202	35,675	474	1.3	-677	1,111	39
NAICS 813 Membership associations and organizations	32,680	33,716	1,037	3.2	-628	1,318	347
NAICS 814 Private households	15,516	20,318	4,802	30.9	-298	2,817	2,283

Table A-3:

Shift-share Analysis of Changes in Massachusetts Wage and Salary Employment by 4-Digit NAICS Industries, 2004 I-II – 2006 I-II

NAICS INDUSTRY	2004	2006	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
Total, all industries	**2,707,956**	**2,751,529**	**43,573**	**1.6**	**112,576**	**1,419**	**-70,423**
Agriculture, forestry, fishing and hunting	**6,193**	**6,116**	**-78**	**-1.3**	**257**	**-321**	**-14**
NAICS 111 Crop production	2,775	2,661	-114	-4.1	115	-222	-8
NAICS 112 Animal production	551	594	43	7.9	23	-4	24
NAICS 113 Forestry and logging	118	142	24	19.9	5	-9	28
NAICS 114 Fishing, hunting and trapping	1,603	1,521	-82	-5.1	67	-198	49
NAICS 115 Agriculture and forestry support activities	1,147	1,198	51	4.5	48	-28	32
Mining	**1,711**	**1,658**	**-54**	**-3.1**	**71**	**228**	**-352**
NAICS 212 Mining, except oil and gas	1,603	1,622	19	1.2	67	62	-110
Utilities	**10,199**	**9,625**	**-573**	**-5.6**	**424**	**-783**	**-214**
NAICS 221 Utilities	10,199	9,625	-573	-5.6	424	-783	-214
Construction	**131,662**	**136,116**	**4,454**	**3.4**	**5,474**	**9,591**	**-10,611**
NAICS 236 Construction of buildings	30,409	32,119	1,710	5.6	1,264	2,487	-2,041
NAICS 237 Heavy and civil engineering construction	12,386	11,666	-720	-5.8	515	691	-1,926
NAICS 238 Specialty trade contractors	88,867	92,331	3,464	3.9	3,694	6,483	-6,714
Manufacturing	**313,627**	**300,164**	**-13,463**	**-4.3**	**13,038**	**-14,895**	**-11,607**
NAICS 311 Food manufacturing	22,478	22,675	196	0.9	934	-1,269	531
NAICS 312 Beverage and tobacco product manufacturing	2,690	2,556	-134	-5.0	112	-115	-131
NAICS 313 Textile mills	9,102	6,851	-2,251	-24.7	378	-1,900	-729
NAICS 314 Textile product mill	2,878	2,699	-179	-6.2	120	-367	69
NAICS 315 Apparel manufacturing	4,220	3,704	-516	-12.2	175	-877	186
NAICS 316 Leather and allied product manufacturing	2,010	2,618	608	30.3	84	-344	869
NAICS 321 Wood product manufacturing	3,410	3,394	-16	-0.5	142	5	-163
NAICS 322 Paper manufacturing	14,167	12,466	-1,701	-12.0	589	-1,250	-1,040
NAICS 323 Printing and related support activities	16,457	15,945	-513	-3.1	684	-1,352	155
NAICS 324 Petroleum and coal products manufacturing	1,150	1,188	38	3.3	48	-45	36
NAICS 325 Chemical manufacturing	16,321	16,684	362	2.2	679	-1,094	778
NAICS 326 Plastics and rubber products manufacturing	16,600	15,659	-941	-5.7	690	-746	-886
NAICS 327 Nonmetallic mineral product manufacturing	6,488	6,790	302	4.7	270	-54	86
NAICS 331 Primary metal manufacturing	5,630	5,122	-508	-9.0	234	-226	-516
NAICS 332 Fabricated metal product manufacturing	36,203	35,277	-926	-2.6	1,505	-12	-2,419
NAICS 333 Machinery manufacturing	21,809	20,133	-1,677	-7.7	907	-53	-2,530
NAICS 334 Computer and electronic product manufacturing	74,311	71,206	-3,105	-4.2	3,089	-3,667	-2,528
NAICS 335 Electrical equipment and appliance mfg.	11,362	11,261	-101	-0.9	472	-766	192
NAICS 336 Transportation equipment manufacturing	14,280	14,564	284	2.0	594	-506	196
NAICS 337 Furniture and related product manufacturing	5,794	5,531	-264	-4.5	241	-320	-184
NAICS 339 Miscellaneous manufacturing	26,269	23,845	-2,424	-9.2	1,092	-1,272	-2,244
Wholesale trade	**134,779**	**135,772**	**993**	**0.7**	**5,603**	**314**	**-4,924**
NAICS 423 Merchant wholesalers, durable goods	63,522	62,925	-597	-0.9	2,641	166	-3,404
NAICS 424 Merchant wholesalers, nondurable goods	46,978	48,053	1,076	2.3	1,953	-1,213	335
NAICS 425 Electronic markets and agents and brokers	24,280	24,794	514	2.1	1,009	2,005	-2,500

Table A-3 continued:

NAICS INDUSTRY	2004	2006	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
Retail trade	**349,897**	**346,660**	**-3,237**	**-0.9**	**14,546**	**-6,561**	**-11,222**
NAICS 441 Motor vehicle and parts dealers	38,799	37,302	-1,497	-3.9	1,613	-1,461	-1,649
NAICS 442 Furniture and home furnishings stores	12,939	13,166	227	1.8	538	49	-360
NAICS 443 Electronics and appliance stores	12,152	12,957	805	6.6	505	238	62
NAICS 444 Building material and garden supply stores	27,262	27,932	670	2.5	1,133	985	-1,448
NAICS 445 Food and beverage stores	88,643	87,743	-900	-1.0	3,685	-3,931	-654
NAICS 446 Health and personal care stores	26,566	26,599	33	0.1	1,104	-552	-519
NAICS 447 Gasoline stations	12,349	11,874	-475	-3.8	513	-713	-275
NAICS 448 Clothing and clothing accessories stores	37,920	38,232	313	0.8	1,576	558	-1,822
NAICS 451 Sporting goods, hobby, book and music stores	17,356	17,262	-94	-0.5	722	-431	-385
NAICS 452 General merchandise stores	41,863	41,611	-252	-0.6	1,740	145	-2,137
NAICS 453 Miscellaneous store retailers	22,265	20,613	-1,652	-7.4	926	-1,638	-939
NAICS 454 Non store retailers	11,786	11,370	-416	-3.5	490	-447	-459
Transportation and warehousing	**70,029**	**68,785**	**-1,244**	**-1.8**	**2,911**	**664**	**-4,819**
NAICS 481 Air transportation	9,058	7,723	-1,335	-14.7	377	-928	-784
NAICS 483 Water transportation	870	730	-140	-16.1	36	72	-248
NAICS 484 Truck transportation	15,944	15,851	-94	-0.6	663	303	-1,060
NAICS 485 Transit and ground passenger transportation	17,729	17,486	-243	-1.4	737	-15	-965
NAICS 486 Pipeline transportation	119	129	11	9.1	5	-4	9
NAICS 487 Scenic and sightseeing transportation	905	794	-111	-12.2	38	-31	-118
NAICS 488 Support activities for transportation	5,873	6,240	367	6.3	244	214	-91
NAICS 491 Postal service	8	5	-3	-38.3	0	2	-5
NAICS 492 Couriers and messengers	11,736	11,117	-619	-5.3	488	-184	-922
NAICS 493 Warehousing and storage	7,789	8,712	923	11.8	324	739	-140
Information	**87,036**	**86,768**	**-268**	**-0.3**	**3,618**	**-5,580**	**1,694**
NAICS 511 Publishing industries, except Internet	40,757	41,851	1,095	2.7	1,694	-2,025	1,425
NAICS 512 Motion picture and sound recording industries	4,857	4,529	-328	-6.8	202	-228	-303
NAICS 515 Broadcasting, except Internet	5,926	5,686	-240	-4.1	246	-181	-305
NAICS 516 Internet publishing and broadcasting	2,384	2,168	-216	-9.1	99	266	-581
NAICS 517 Telecommunications	22,080	21,192	-888	-4.0	918	-2,395	589
NAICS 518 ISPs, search portals, and data processing	9,774	10,080	306	3.1	406	-417	317
NAICS 519 Other information services	1,258	1,262	4	0.3	52	-22	-27
Finance and insurance	**172,720**	**178,256**	**5,537**	**3.2**	**7,180**	**-1,287**	**-357**
NAICS 522 Credit intermediation and related activities	62,269	62,893	624	1.0	2,589	11	-1,976
NAICS 523 Securities, commodity contracts, investments	45,570	47,259	1,690	3.7	1,894	1,267	-1,472
NAICS 524 Insurance carriers and related activities	61,505	64,650	3,145	5.1	2,557	-1,905	2,493
Real estate and rental and leasing	43,837	43,929	92	0.2	1,822	42	-1,772
NAICS 531 Real estate	30,097	31,443	1,347	4.5	1,251	611	-516
NAICS 532 Rental and leasing services	13,306	12,004	-1,302	-9.8	553	-565	-1,290
NAICS 533 Lessors of non financial intangible assets	434	482	48	11.0	18	11	19
Professional and technical services	**221,912**	**238,805**	**16,893**	**7.6**	**9,225**	**10,884**	**-3,217**
NAICS 541 Professional and technical services	221,912	238,805	16,893	7.6	9,225	10,884	-3,217
Management of companies and enterprises	**64,196**	**62,745**	**-1,451**	**-2.3**	**2,669**	**733**	**-4,853**

Table A-3 continued:

NAICS INDUSTRY	2004	2006	ABSOLUTE CHANGE	PERCENT CHANGE	NS	IM	RS
NAICS 551 Management of companies and enterprises	64,196	62,745	-1,451	-2.3	2,669	733	-4,853
Administrative and waste services	**156,136**	**162,934**	**6,798**	**4.4**	**6,491**	**4,189**	**-3,883**
NAICS 561 Administrative and support services	147,435	153,370	5,934	4.0	6,129	3,953	-4,148
NAICS 562 Waste management and remediation services	8,701	9,564	863	9.9	362	238	264
Educational services	**117,460**	**121,159**	**3,699**	**3.1**	**4,883**	**2,425**	**-3,609**
NAICS 611 Educational services	117,460	121,159	3,699	3.1	4,883	2,425	-3,609
NAICS 62 Health care and social assistance	429,186	446,678	17,492	4.1	17,842	3,303	-3,653
NAICS 621 Ambulatory health care services	122,972	129,235	6,263	5.1	5,112	3,609	-2,458
NAICS 622 Hospitals	155,822	163,511	7,689	4.9	6,478	-2,328	3,539
NAICS 623 Nursing and residential care facilities	89,537	91,610	2,073	2.3	3,722	-1,627	-22
NAICS 624 Social assistance	60,856	62,323	1,467	2.4	2,530	2,361	-3,424
NAICS 71 Arts, entertainment, and recreation	43,336	43,118	-218	-0.5	1,802	-632	-1,387
NAICS 711 Performing arts and spectator sports	7,762	7,547	-215	-2.8	323	-124	-414
NAICS 712 Museums, historical sites, zoos, and parks	4,936	4,962	26	0.5	205	-58	-121
NAICS 713 Amusements, gambling, and recreation	30,638	30,610	-28	-0.1	1,274	-443	-859
NAICS 72 Accommodation and food services	237,215	241,665	4,451	1.9	9,862	2,034	-7,445
NAICS 721 Accommodation	31,026	31,332	306	1.0	1,290	-585	-399
NAICS 722 Food services and drinking places	206,188	210,333	4,145	2.0	8,572	2,904	-7,331
NAICS 81 Other services, except public administration	116,825	120,574	3,749	3.2	4,857	-2,928	1,820
NAICS 811 Repair and maintenance	27,116	26,275	-840	-3.1	1,127	-764	-1,203
NAICS 812 Personal and laundry services	35,675	35,885	209	0.6	1,483	-1,065	-209
NAICS 813 Membership associations and organizations	33,716	36,133	2,417	7.2	1,402	-1,038	2,054
NAICS 814 Private households	20,318	22,281	1,963	9.7	845	193	926

APPENDIX B: ESTIMATING EMPLOYMENT DATA FOR TWO LARGE MISSING INDUSTRIES IN MASSACHUSETTS

The employment data for some industries within states at refined level of NAICS industrial detail are not disclosed by the Bureau of Labor Statistics due to confidentiality requirements. Two hi-technology industries with a large number of employees in Massachusetts for whom data were not disclosed were computer storage manufacturing (NAICS 334112) and computer terminal manufacturing (NAICS 334113). Companies like EMC located in Hopkinton Massachusetts, which employs more than 8,000 employees, fall under the computer storage device manufacturing industry (NAICS 334112). All other industries for whom payroll employment data were not disclosed in Massachusetts have a very small share of employment in hi tech industries of the state.

To estimate employment in these two large missing industries, we looked at employment in computer and peripheral manufacturing industry, which is comprised of four NAICS industries as displayed in Table B-1. The total level of employment in the computer and peripheral manufacturing industry includes employment of industries that were not disclosed. Since data for two industries under computer and peripheral manufacturing were disclosed, we took the difference between total employment in the computer and peripheral manufacturing industry and the sum of employment in the other two industries. Total estimated employment in the two missing industries is displayed in row 6 of Table B-1. Employment in computer storage device and other computer peripheral manufacturing industries increased from 5,829 in 1990 to 8,432 in 2000 and to 8,093 in 2005. Overall employment during 2000 and 2005 has declined in these two industries; however, their employment level increased by nearly 41 percent between 1990 and 2005. The strong employment trend in these industries in Massachusetts is primarily due to the presence of a large computer storage manufacturing firm such as EMC. The company has performed well despite the downturn in the hi-tech sector in recent years. For the entire nation, employment in these two industries declined between 20 and 37% during 2000 and 2005.

Table B-1:

Trends in Employment in Computer and Peripheral Manufacturing Industry in Massachusetts and the U.S., 1990-2000

	EMPLOYMENT			% CHANGE		
MASSACHUSETTS	**1990**	**2000**	**2005**	**1990-00**	**2000-05**	**1990-05**
NAICS 3341 Computer and peripheral mfg.	35,171	21,207	16,216	-39.7	-23.5	-63.2
NAICS 334111 Electronic computer mfg.	26,219	9,622	5,893	-63.3	-38.8	-102.1
NAICS 334112 Computer storage device mfg.	(ND)	(ND)	(ND)			
NAICS 334113 Computer terminal mfg.	(ND)	(ND)	(ND)			
NAICS 334119 Other computer peripheral equipment mfg.	3,123	3,153	2,230	1.0	-29.3	-28.3
Employment in 334112 and 334113	5,829	8,432	8,093	44.7	-4.0	40.6
U.S.						
NAICS 3341 Computer and peripheral mfg.	317,993	289,684	203,578	-8.9	-29.7	-38.6
NAICS 334111 Electronic computer mfg.	201,974	157,371	111,438	-22.1	-29.2	-51.3
NAICS 334112 Computer storage device mfg.	35,957	38,022	30,550	5.7	-19.7	-13.9
NAICS 334113 Computer terminal mfg.	16,182	24,270	15,374	50.0	-36.7	13.3
NAICS 334119 Other computer peripheral equipment mfg.	63,880	70,022	46,216	9.6	-34.0	-24.4

Appendix B-2:

American Electronics Association's (AeA) Classification of Hi-Tech Industries by Their NAICS Codes

NAICS	NAME OF INDUSTRY
I. MANUFACTURING	
Computer & Peripheral Equipment	
334111	Electronic Computers
334112	Computer Storage Device
334113	Computer Terminals
334119	Other Computer Peripheral Equipment
Communications Equipment	
334210	Telephone Apparatus
334220	Radio & TV Broadcasting & Wireless
Communications Equipment	
334290	Other Communications Equipment
335921	Fiber Optic Cables
Consumer Electronics	
334310	Audio & Video Equipment
Electronic Components	
334411	Electron Tubes
334412	Bare Printed Circuit Boards
334414	Electronic Capacitors
334415	Electronic Resistors
334416	Electronic Coils, Transformers, & Other Inductors
334417	Electronic Connectors
334418	Printed Electronic Components
334419	Other Electronic Components
Semiconductors	
334413	Semiconductors & Related Devices
332995	Semiconductor Machinery
Defense Electronics	
334511	Search, Detection, Navigation, Guidance, Aeronautical, ands Nautical Systems and Equipments
Measuring & Control Instruments	
334512	Automatic Environmental Controls
334513	Industrial Process Control Instruments
334514	Totalizing Fluid Meter & Counting Devices
334515	Electricity Measuring and Testing Equipment
334516	Analytical Laboratory Instruments
334519	Other Measuring & Controlling Instruments
Electromedical Equipment	
334510	Electromedical & Electrotherapeutic Apparatus
334517	Irradiation Apparatus
Photonics	
333314	Optical Instrument and Lens
333315	Photographic & Photocopying Equipment
II. COMMUNICATIONS SERVICES	
Communications Services	
517110	Wired Communications Carriers
517211	Paging Services
517212	Cellular & Other Wireless Telecommunications
517310	Telecommunications Resellers
517410	Satellite Telecommunications
517510	Cable & Other Program Distribution
517910	Other Telecommunications
III. SOFTWARE & TECH SERVICES	
Software Publishers	
511210	Software Publishers
Computer Systems Design & Related Services	
541511	Custom Computer Programming
541512	Computer Systems Design
541513	Computer Facilities Management
541519	Other Computer Related Services
Internet Services	
518111	Internet Service Providers
518112	Web Search Portals
518210	Data Processing, Hosting, & Related Services
Engineering Services	
541330	Engineering Services
R&D Testing Labs	
541710	Research & Development in the Physical, Engineering, & Life Sciences
541380	Testing Laboratories
Computer Training	
611420	Computer Training

Source: American Electronics Association (AeA), www.aeanet.org

APPENDIX C: DETAILED OUTMIGRATION TABLES

Table C-1:

Net Domestic Out-Migrants During July 2000-July 2006 as a Percent of the Resident Population in 2000 by State

AREA	POPULATION 2000	OUT MIGRANTS, 2000-2006	MIGRANTS AS PERCENT OF POPULATION	STATE RANKING OF OUT-MIGRANTS SHARE RANK	STATE	
United States	282,216,952	0				
Alabama	4,452,375	42,641	1.0	1	Dist of Columbia	-10.6
Alaska	627,533	-3,436	-0.5	2	Louisiana	-7.4
Arizona	5,166,693	541,283	10.5	3	New York	-6.5
Arkansas	2,678,610	55,141	2.1	**4**	**Massachusetts**	**-4.6**
California	34,008,499	-950,592	-2.8	5	Illinois	-3.8
Colorado	4,327,409	80,057	1.8	6	North Dakota	-3.3
Connecticut	3,412,539	-53,125	-1.6	7	New Jersey	-3.3
Delaware	786,505	33,419	4.2	8	California	-2.8
Dist of Columbia	571,042	-60,644	-10.6	9	Kansas	-2.4
Florida	16,050,166	1,221,540	7.6	10	Michigan	-2.4
Georgia	8,230,550	378,258	4.6	11	Ohio	-2.1
Hawaii	1,212,113	-9,275	-0.8	12	Nebraska	-1.8
Idaho	1,299,811	83,870	6.5	13	Rhode Island	-1.8
Illinois	12,440,970	-473,713	-3.8	14	Connecticut	-1.6
Indiana	6,092,375	-17,818	-0.3	15	Iowa	-1.4
Iowa	2,928,703	-41,489	-1.4	16	Mississippi	-0.9
Kansas	2,692,947	-65,589	-2.4	17	Utah	-0.8
Kentucky	4,049,260	44,188	1.1	18	Hawaii	-0.8
Louisiana	4,469,529	-330,492	-7.4	19	Alaska	-0.5
Maine	1,277,483	36,792	2.9	20	Minnesota	-0.5
Maryland	5,311,695	-13,017	-0.2	21	Indiana	-0.3
Massachusetts	**6,362,604**	**-289,967**	**-4.6**	22	Maryland	-0.2
Michigan	9,956,689	-239,349	-2.4	23	Pennsylvania	-0.2
Minnesota	4,934,275	-26,574	-0.5	24	Oklahoma	-0.1
Mississippi	2,848,634	-25,280	-0.9	25	South Dakota	0.1
Missouri	5,606,532	37,638	0.7	26	Wisconsin	0.2
Montana	903,531	24,944	2.8	27	Vermont	0.5
Nebraska	1,713,426	-31,457	-1.8	28	Missouri	0.7
Nevada	2,018,456	318,182	15.8	29	West Virginia	0.7
New Hampshire	1,240,664	40,531	3.3	30	Wyoming	0.9
New Jersey	8,434,216	-277,900	-3.3	31	Alabama	1.0
New Mexico	1,821,656	22,887	1.3	32	Kentucky	1.1
New York	19,000,135	-1,242,869	-6.5	33	New Mexico	1.3
North Carolina	8,078,909	347,005	4.3	34	Virginia	1.8
North Dakota	641,193	-21,149	-3.3	35	Colorado	1.8
Ohio	11,364,401	-237,819	-2.1	36	Arkansas	2.1
Oklahoma	3,454,508	-4,799	-0.1	37	Texas	2.2

Table C-1 continued:

AREA	POPULATION 2000	OUT MIGRANTS, 2000-2006	MIGRANTS AS PERCENT OF POPULATION	STATE RANKING OF OUT-MIGRANTS SHARE RANK	STATE	
Oregon	3,431,530	108,748	3.2	38	Washington	2.2
Pennsylvania	12,286,905	-27,718	-0.2	39	Montana	2.8
Rhode Island	1,050,836	-18,742	-1.8	40	Tennessee	2.8
South Carolina	4,023,565	167,070	4.2	41	Maine	2.9
South Dakota	755,793	470	0.1	42	Oregon	3.2
Tennessee	5,703,299	160,166	2.8	43	New Hampshire	3.3
Texas	20,951,848	451,910	2.2	44	South Carolina	4.2
Utah	2,243,490	-17,709	-0.8	45	Delaware	4.2
Vermont	609,986	2,822	0.5	46	North Carolina	4.3
Virginia	7,104,587	124,544	1.8	47	Georgia	4.6
Washington	5,912,036	129,809	2.2	48	Idaho	6.5
West Virginia	1,807,528	12,772	0.7	49	Florida	7.6
Wisconsin	5,374,747	9,224	0.2	50	Arizona	10.5
Wyoming	494,166	4,611	0.9	51	Nevada	15.8

Source: State Population Estimates, U.S. Census Bureau, tabulations by authors.

Table C-2:

Aggregate Wage and Salary Employment Levels, 2000 to 2005, by State

STATE	2000	2005	ABSOLUTE CHANGE	RELATIVE CHANGE
Alabama	1,877,963	1,894,616	16,653	0.9
Alaska	275,607	302,330	26,723	9.7
Arizona	2,220,712	2,489,462	268,750	12.1
Arkansas	1,130,891	1,147,615	16,724	1.5
California	14,867,006	15,234,188	367,182	2.5
Colorado	2,186,656	2,189,516	2,860	0.1
Connecticut	1,674,728	1,644,274	-30,454	-1.8
Delaware	406,350	417,692	11,342	2.8
Dist of Columbia	637,292	667,512	30,220	4.7
Florida	7,060,986	7,747,729	686,743	9.7
Georgia	3,883,005	3,932,315	49,310	1.3
Hawaii	553,185	603,668	50,483	9.1
Idaho	563,193	614,548	51,355	9.1
Illinois	5,940,772	5,748,355	-192,417	-3.2
Indiana	2,936,634	2,873,795	-62,839	-2.1
Iowa	1,443,394	1,446,568	3,174	0.2
Kansas	1,313,742	1,305,440	-8,302	-0.6
Kentucky	1,762,949	1,757,997	-4,952	-0.3
Louisiana	1,869,219	1,841,046	-28,173	-1.5

Table C-2 continued:

STATE	2000	2005	ABSOLUTE CHANGE	RELATIVE CHANGE
Maine	590,818	594,481	3,663	0.6
Maryland	2,405,510	2,497,487	91,977	3.8
Massachusetts	**3,275,135**	**3,159,934**	**-115,201**	**-3.5**
Michigan	4,585,211	4,297,017	-288,194	-6.3
Minnesota	2,608,543	2,640,326	31,783	1.2
Mississippi	1,137,304	1,111,269	-26,035	-2.3
Missouri	2,677,110	2,664,447	-12,663	-0.5
Montana	379,094	413,460	34,366	9.1
Nebraska	882,918	892,397	9,479	1.1
Nevada	1,017,902	1,215,783	197,881	19.4
New Hampshire	606,543	620,893	14,350	2.4
New Jersey	3,877,572	3,917,397	39,825	1.0
New Mexico	717,243	778,233	60,990	8.5
New York	8,471,416	8,348,739	-122,677	-1.4
North Carolina	3,862,782	3,856,748	-6,034	-0.2
North Dakota	309,223	328,097	18,874	6.1
Ohio	5,513,217	5,308,808	-204,409	-3.7
Oklahoma	1,452,166	1,465,969	13,803	1.0
Oregon	1,608,069	1,652,773	44,704	2.8
Pennsylvania	5,558,076	5,552,301	-5,775	-0.1
Rhode Island	467,602	477,420	9,818	2.1
South Carolina	1,820,138	1,819,217	-921	-0.1
South Dakota	364,119	375,707	11,588	3.2
Tennessee	2,667,230	2,685,491	18,261	0.7
Texas	9,289,286	9,583,457	294,171	3.2
Utah	1,044,143	1,115,375	71,232	6.8
Vermont	296,462	300,919	4,457	1.5
Virginia	3,427,954	3,578,558	150,604	4.4
Washington	2,706,462	2,766,451	59,989	2.2
West Virginia	686,622	695,382	8,760	1.3
Wisconsin	2,736,054	2,744,006	7,952	0.3
Wyoming	230,857	254,418	23,561	10.2
U.S. Total	129,877,065	131,571,626	1,694,561	1.3

Source: Quarterly Censuses of Employment and Wages (QCEW), U.S. Bureau of Labor Statistics, tabulations by authors.

Table C-3:

Education Adjusted Relative Median Annual Earnings of Full-Time, Year-Round Workers in 2005, by State

STATE	EDUCATION ADJUSTED MEDIAN EARNINGS, 2005	STATE'S RELATIVE MEDIAN EARNINGS
Alabama	$34,102	0.870
Alaska	$43,390	1.107
Arizona	$38,113	0.972
Arkansas	$32,244	0.822
California	$43,514	1.110
Colorado	$39,174	0.999
Connecticut	$46,253	1.180
Delaware	$41,012	1.046
District of Columbia	$41,464	1.058
Florida	$35,499	0.905
Georgia	$38,235	0.975
Hawaii	$38,094	0.972
Idaho	$33,473	0.854
Illinois	$40,545	1.034
Indiana	$38,237	0.975
Iowa	$35,364	0.902
Kansas	$34,479	0.879
Kentucky	$35,042	0.894
Louisiana	$34,259	0.874
Maine	$33,876	0.864
Maryland	$44,404	1.133
Massachusetts	**$44,578**	**1.137**
Michigan	$41,181	1.050
Minnesota	$40,058	1.022
Mississippi	$31,395	0.801
Missouri	$35,332	0.901
Montana	$31,444	0.802
Nebraska	$33,612	0.857
Nevada	$38,865	0.991
New Hampshire	$41,163	1.050
New Jersey	$46,643	1.190
New Mexico	$33,656	0.858
New York	$40,542	1.034
North Carolina	$35,209	0.898
North Dakota	$32,558	0.830
Ohio	$38,708	0.987
Oklahoma	$32,634	0.832
Oregon	$38,030	0.970
Pennsylvania	$39,275	1.002
Rhode Island	$41,008	1.046
South Carolina	$33,474	0.854
South Dakota	$30,676	0.782
Tennessee	$34,506	0.880
Texas	$37,113	0.947
Utah	$36,251	0.925
Vermont	$36,490	0.931
Virginia	$41,539	1.059
Washington	$41,379	1.055
West Virginia	$33,103	0.844
Wisconsin	$38,094	0.972
Wyoming	$33,421	0.852
Total	$39,207	1.000

Source: Public use files, 2005 American Community Survey (ACS), U.S. Census Bureau, tabulations by authors.

Table C-4:

Housing Affordability Ratios of U.S. States, 1999 and 2005

STATE	MEDIAN HOUSEHOLD INCOME IN 1999	MEDIAN VALUE OF HOME 1999	AFFORDABILITY RATIO, 1999	MEDIAN HOUSEHOLD INCOME, 2005	MEDIAN VALUE OF HOME, 2005	AFFORDABILITY RATIO, 2005	SIMPLE AVERAGE OF AFFORDABILITY RATIOS, 1999 AND 2005
Alabama	$34,135	$85,100	2.493	$36,879	$97,500	2.644	2.568
Alaska	$51,571	$144,200	2.796	$56,234	$197,100	3.505	3.151
Arizona	$40,558	$121,300	2.991	$44,282	$185,400	4.187	3.589
Arkansas	$32,182	$72,800	2.262	$34,999	$87,400	2.497	2.380
California	$47,493	$211,500	4.453	$53,629	$477,700	8.907	6.680
Colorado	$47,203	$166,600	3.529	$50,652	$223,300	4.409	3.969
Connecticut	$53,935	$166,900	3.094	$60,941	$271,500	4.455	3.775
Delaware	$47,381	$130,400	2.752	$52,499	$203,800	3.882	3.317
Dist of Col.	$40,127	$157,200	3.918	$47,221	$384,400	8.140	6.029
Florida	$38,819	$105,500	2.718	$42,433	$189,500	4.466	3.592
Georgia	$42,433	$111,200	2.621	$45,604	$147,500	3.234	2.927
Hawaii	$49,820	$272,700	5.474	$58,112	$453,600	7.806	6.640
Idaho	$37,572	$106,300	2.829	$41,443	$134,900	3.255	3.042
Illinois	$46,590	$130,800	2.807	$50,260	$183,900	3.659	3.233
Indiana	$41,567	$94,300	2.269	$43,993	$114,400	2.600	2.435
Iowa	$39,469	$82,500	2.090	$43,609	$106,600	2.444	2.267
Kansas	$40,624	$83,500	2.055	$42,920	$107,800	2.512	2.284
Kentucky	$33,672	$86,700	2.575	$37,369	$103,900	2.780	2.678
Louisiana	$32,566	$85,000	2.610	$36,729	$101,700	2.769	2.690
Maine	$37,240	$98,700	2.650	$42,801	$155,300	3.628	3.139
Maryland	$52,868	$146,000	2.762	$61,592	$280,200	4.549	3.655
Massachusetts	**$50,502**	**$185,700**	**3.677**	**$57,184**	**$361,500**	**6.322**	**4.999**
Michigan	$44,667	$115,600	2.588	$46,039	$149,300	3.243	2.915
Minnesota	$47,111	$122,400	2.598	$52,024	$198,800	3.821	3.210
Mississippi	$31,330	$71,400	2.279	$32,938	$82,700	2.511	2.395
Missouri	$37,934	$89,900	2.370	$41,974	$123,100	2.933	2.651
Montana	$33,024	$99,500	3.013	$39,301	$131,600	3.349	3.181
Nebraska	$39,250	$88,000	2.242	$43,849	$113,200	2.582	2.412
Nevada	$44,581	$142,000	3.185	$49,169	$283,400	5.764	4.475
New Hampshire	$49,467	$133,300	2.695	$56,768	$240,100	4.229	3.462
New Jersey	$55,146	$170,800	3.097	$61,672	$333,900	5.414	4.256
New Mexico	$34,133	$108,100	3.167	$37,492	$125,500	3.347	3.257
New York	$43,393	$148,700	3.427	$49,480	$258,900	5.232	4.330
North Carolina	$39,184	$108,300	2.764	$40,729	$127,600	3.133	2.948
North Dakota	$34,604	$74,400	2.150	$41,030	$88,600	2.159	2.155
Ohio	$40,956	$103,700	2.532	$43,493	$129,600	2.980	2.756
Oklahoma	$33,400	$70,700	2.117	$37,063	$89,100	2.404	2.260
Oregon	$40,916	$152,100	3.717	$42,944	$201,200	4.685	4.201
Pennsylvania	$40,106	$97,000	2.419	$44,537	$131,900	2.962	2.690

Table C-4 continued:

STATE	MEDIAN HOUSEHOLD INCOME IN 1999	MEDIAN VALUE OF HOME 1999	AFFORDABILITY RATIO, 1999	MEDIAN HOUSEHOLD INCOME, 2005	MEDIAN VALUE OF HOME, 2005	AFFORDABILITY RATIO, 2005	SIMPLE AVERAGE OF AFFORDABILITY RATIOS, 1999 AND 2005
Rhode Island	$42,090	$133,000	3.160	$51,458	$281,300	5.467	4.313
South Carolina	$37,082	$94,900	2.559	$39,316	$113,100	2.877	2.718
South Dakota	$35,282	$79,600	2.256	$40,310	$101,700	2.523	2.390
Tennessee	$36,360	$93,000	2.558	$38,874	$114,000	2.933	2.745
Texas	$39,927	$82,500	2.066	$42,139	$106,000	2.515	2.291
Utah	$45,726	$146,100	3.195	$47,934	$167,200	3.488	3.342
Vermont	$40,856	$111,500	2.729	$45,686	$173,400	3.795	3.262
Virginia	$46,677	$125,400	2.687	$54,240	$212,300	3.914	3.300
Washington	$45,776	$168,300	3.677	$49,262	$227,700	4.622	4.149
West Virginia	$29,696	$72,800	2.452	$33,452	$84,400	2.523	2.487
Wisconsin	$43,791	$112,200	2.562	$47,105	$152,600	3.240	2.901
Wyoming	$37,892	$96,600	2.549	$46,202	$135,000	2.922	2.736
United States	$41,994	$119,600	2.848	$46,242	$167,500	3.622	3.235

Sources: Public use files, 2000 Census of Population and Housing and 2005 American Community Survey (ACS), U.S. Census Bureau, tabulations by authors.

Notes

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