Mode Shift in the 1990s

How Subway and Bus Ridership Outpaced the Auto in Market Share Gains in New York City

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Summary

After decades in which public transit lost ridership and market share to the automobile, ridership on subways and buses rose far more rapidly in the 1990s than did auto ownership or auto trip making.

- Subway ridership increased 34% during the 1990s while the number of autos owned by city residents increased by only 6%—a difference in growth rates of 28 percentage points in favor of the subway. Bus ridership increased 27%, a difference in growth rates with auto ownership of 21 percentage points in favor of the bus.
- This represents a remarkable turnaround from trends in the 1950s through 1980s. In each of these decades, changes in auto ownership exceeded subway ridership changes by 18 to 20 percentage points. For example, in the 1980s auto ownership increased by 21% while subway ridership grew by only 2%. (Bus ridership declined by 15% in the 1980s.)
- Mode shares shifted from greater auto use in the 1980s and earlier decades to greater public transit use in the 1990s. The automobile's estimated mode share declined by 4 percentage points from 48% to 44% of all trips within New York City in the 1990s, after increasing by 7 percentage points in the 1980s. The subway's estimated market share increased by 2 percentage points to 31% mode share in the 1990s after declining by 3 points in the 1980s. The market share for buses increased by one percentage point to 16% of trips in the 1990s after declining by 5 points in the previous decade.

Mode shift in the 1990s shows the impact of shifting public investment priorities. While public policy focused on expressway building in the 1950s and 1960s, starting in the 1980s major capital investments were poured into improving the reliability, comfort and convenience of subways and buses. Other forces were also critical to mode shift, including increased immigration, drop in the crime rate, increased traffic congestion, increased parking costs and patterns of economic growth, commercial and residential development. These diverse forces combined to bring about New York's unprecedented mode shift of the 1990s.

This experience has several important implications for future public policy decisions. First, it shows that public policy choices and public spending can decisively alter the shape and use of the city's transportation system.

Second, it shows that public investment is most effective when improvements capitalize on social and economic trends and land use policies. Finally, it shows that improvements to existing transit service are just as important as system expansion. Mode shift came about because transit investments focused on the needs of the 1980s and early 1990s—service reliability, personal safety, comfort and fare integration. The next generation of improvements should focus on today's needs and opportunities. These include increasing service levels, relief of overcrowding on buses and trains, speeding up bus travel times, and providing extensive and real-time customer information.

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Introduction

What if someone had suggested a decade ago that subway and bus ridership in New York City would outpace the growth of private automobile ownership and usage? And what if it was suggested that public transit would not only outpace auto growth but do so by a decisive margin?

Such a development was unimaginable in the early 1990s. Public transit ridership had lagged far behind auto growth for over four decades. Dragged down by a recession, subway ridership in 1991 and 1992 fell below the levels of the mid-1970s. Bus ridership continued its decades-long decline. The number of cars owned by city residents, on the other hand, increased by 19% over the previous twenty years.

But public transit growth did in fact outstrip auto growth in the '90s in New York City. Subway ridership increased 34% during the 1990s while the number of autos owned by city residents increased by only 6%—a difference in growth rates of 28 percentage points. These figures are in sharp contrast to those for the 1950s through the 1980s, decades in which New Yorkers consistently moved toward ever-greater reliance on auto travel. In each of these decades, changes in auto ownership exceeded subway ridership changes by 18 to 20 percentage points.

The reversal toward public transit use in the 1990s shows the impact of public investment decisions combined with societal forces such as surging immigration and falling crime rates. In the 1950s and 1960s transportation investments were concentrated on expanding the city's highway network rather than expanding or maintaining the transit system. While the subway and bus system deteriorated to the point of near collapse, highway investment facilitated a large increase in auto ownership and usage in the city, as detailed below. Major capital investments starting in the early 1980s brought tremendous improvements in the reliability and comfort of subway service. Combined with MetroCard fare initiatives, transit became far more attractive to the public while highways and streets became more congested.

This report examines three questions: how did mode shares change? Why did they change? What does the mode shift of the 1990s teach us?

In analyzing the "what" and the "why," this report seeks to help inform the debate among New York City and State officials, candidates in this fall's city elections and the public as they weigh alternative transportation policies. These alternatives include funding major investments such as a Second Avenue subway and West Side and airport subway extensions as well as more-immediate steps to increase and improve bus and subway service and facilitate transit, bicycle and pedestrian travel.

The mode shift of the 1990s is an object lesson for public discussion about transportation spending and priorities. It shows that public policy choices and public spending can decisively alter the shape and use of the city's transportation system.

1950-1990: The Auto Ascendant

The significance of mode shift in the 1990s is best understood when viewed in contrast to the motor vehicle's ascendance as the primary means of transportation in the United States and to a lesser extent in New York City.

Nationally, 88.5% of American households owned a car and a majority owned two or more motor vehicles in 1990.[1] As of 1995, auto ownership had become so pervasive in the U.S. that the number of vehicles equaled the number of licensed drivers.[2] Motor vehicles accounted for the lion's share of Americans' travel, accounting for 89.3% of all trips in the U.S. in 1995. Walk trips were a distant second, accounting for 5.5% of trips, followed by school buses and public transit, each providing 1.8% of trips.[3]

Residents of New York City, which boasts the most extensive subway and bus network in the country, were not immune to the attractiveness of the auto's speed, convenience and comfort. The number of automobiles owned by city residents increased by approximately 44% from 1950 to 1990.[4] Auto trips within New York City increased at a higher rate as the average auto was used more often. The third of a century between 1963 and 1997 saw an 89% increase in weekday auto trips in New York City. Over the same period, public transit trips declined by 15%. Mode shares shifted decisively toward the auto, which accounted for 33% of all non-walk trips in 1963 and 50% in 1997. Public transit's mode share declined from 61% to 42%. (See Figure 1.)

Mode shift in the 1950-90 period occurred for a number of reasons. Population growth was concentrated in the outerboroughs of the city where streets were less clogged and parking was more readily available. Growing crime in the late 1960s and 1970s discouraged subway use. Income growth enabled more New Yorkers to buy a personal automobile.

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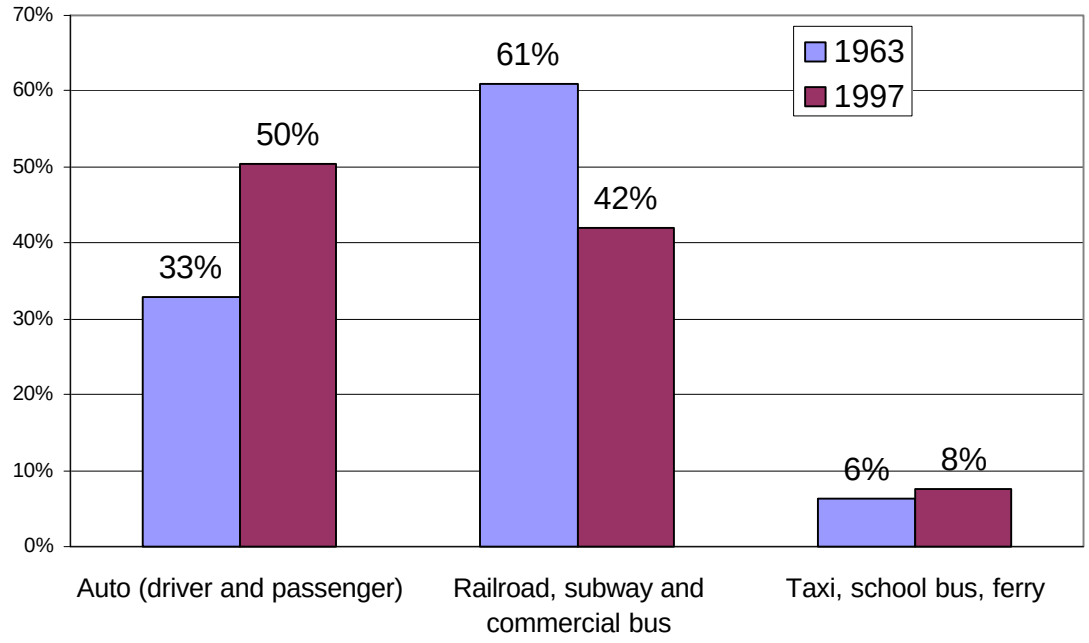
[1] A.E. Pisarski, *Commuting in America II*, Eno Transportation Foundation, Inc. (1996).

[2] P.S. Hu and J.R. Young, *Summary of Travel Trends [from the] 1995 Nationwide Personal Transportation Survey*, U.S. Department of Transportation, Federal Highway Administration (December 1999) p. 7. This report and other information from the NPTS is available at http://www.fhwa.dot.gov/ohim/nptspage.htm.

[3] D. Pickrell and P. Schimek, "Trends in Personal Motor Vehicle Ownership and Use: Evidence from the Nationwide Personal Transportation Survey," in U.S. Department of Transportation, Federal Highway Administration, *Proceedings from the Nationwide Personal Transportation Survey Symposium, October 29-31, 1997 (*February 1999), p. 100.

[4] This figure is calculated from data in Table 1 below.

Figure 1. Mode Shares, 1963 and 1997



Based on author's analysis of data from the 1997/98 Household Interview Survey conducted for the New York Metropolitan Transportation Council and North Jersey Transportation Planning Authority, and Tri-State Regional Planning Commission, "Interim Technical Report 4233-2250, County-to-County Travel, 1963 Home Interview Survey Findings" (June 1971). Data are for weekday trips by New York metro area residents that both originate and end in New York City. Modes are for the "main mode" of travel, generally the mode covering the longest distance for trips involving two or more means of transportation. Data exclude walk-only trips and trips by children under 5, neither of which were counted in the 1963 survey.

In addition, major expansions of the highway network provided additional capacity for auto travel. Nearly all the expressways in New York City were built between the late 1940s and the mid-1960s. For example, the Cross Bronx Expressway, most of the Long Island, Brooklyn-Queens and Van Wyck Expressways and the Harlem River Drive were built in the 1950s. The Gowanus Expressway was converted from a parkway and widened. In the late 1950s and 1960s, the Bruckner Expressway was built in the Bronx and several highways were constructed on Staten Island. Several water crossings also opened for traffic in this time period including the Brooklyn Battery Tunnel (opened 1950), Throgs Neck Bridge (1961) and Verrazano-Narrows Bridge (1964).

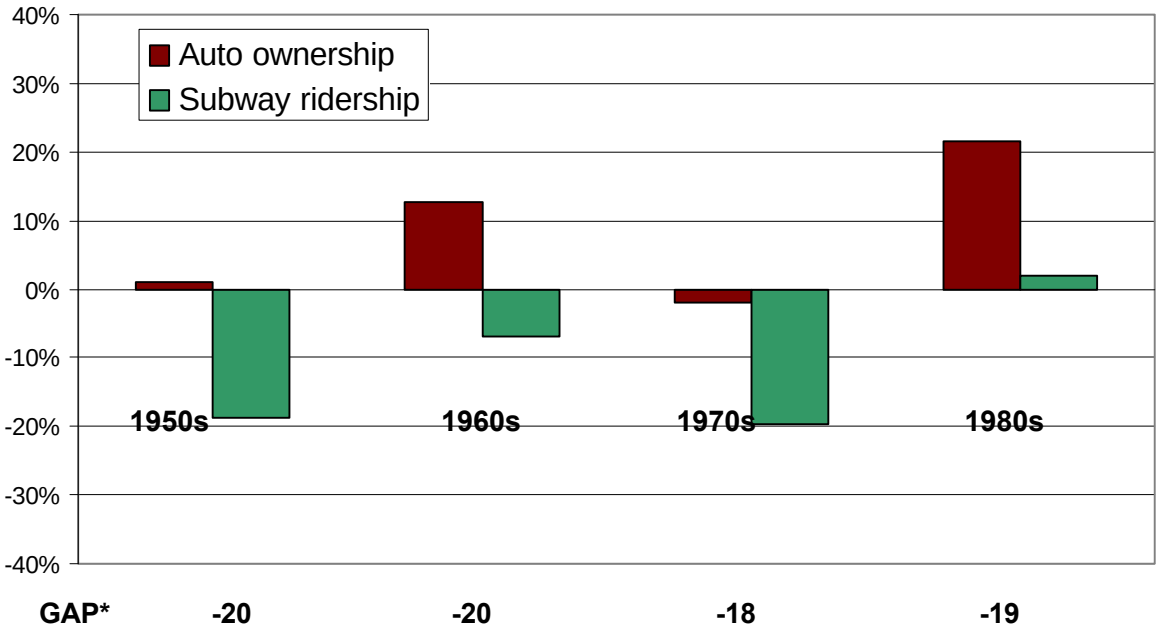
Mode shift occurred at a fairly steady rate from the 1950s through the 1980s, as measured by changes in auto ownership and subway ridership. In each of these decades, the change in subway ridership fell short of auto ownership growth by 18 to 20 percentage points:

- In the 1950s, the gap was 20 percentage points—auto ownership increased 1% while subway ridership dropped 19%.
- In the 1960s, the gap was also 20 percentage points—a 13% increase in autos and 7% decline in subway ridership.
- In the 1970s, the gap was 18 points—2% decline in autos but 20% decline in subway ridership.
- In the 1980s, the gap was 19 points—21% increase in autos owned by city residents and 2% increase in subway ridership. (See Figure 2.)

The number of automobiles owned by New Yorkers is used to chart changes in auto travel in this analysis because no data are available showing the decade-by-decade change in auto trips. In fact, as shown below by estimates of auto trips and mode share of trips since 1980, auto ownership proves to be a reasonable proxy for auto trips for the purposes of this analysis.[5] Subway ridership is used as the indicator of public transit use due to unavailability of bus ridership data prior to 1970.

Figure 2. Modal Growth, 1950s to 1980s

Percent change in auto ownership and subway ridership, 1950s to 1980s.



* Gap is percent change in subway ridership minus percent change in auto ownership.

[5] The distinction between auto ownership and auto trips is important because of the increase in trips per auto.

In addition to the private auto, taxi and livery services grew rapidly during the post-World War II era. Although the number of medallion cabs was frozen throughout these years, explosive growth in livery services (i.e., car services and black cars) generated growth in the number of taxi/livery cars far exceeding increases in private auto ownership. The number of taxi/livery vehicles increased 21% in the 1950s, rising to 38% in the 1960s and 61% in the 1970s, before settling back to 30% in the '80s.

Bus ridership lagged behind auto, taxi/livery and subway ridership, declining by 32% in the 1970s and 15% in the 1980s.

These trends indicated that it would be a major challenge to attract auto users back to the transit system. Focus groups of auto users conducted for the Port Authority of New York and New Jersey in the mid-'80s showed the types of steps that would need to be taken. The research found that auto users could be classified into two groups. One group was composed of people who would not use public transportation because it did not meet their needs—stations were too far from homes, they needed a car during the workday, etc. The second group felt that the auto was the superior travel option given travel cost, travel time, reliability, predictability and safety.[6] Reversing the car's growing dominance would require transit to compete effectively with the auto on these criteria.

Mode Shift in the 1990s

The mode shift of the 1990s could not have been more dramatic:

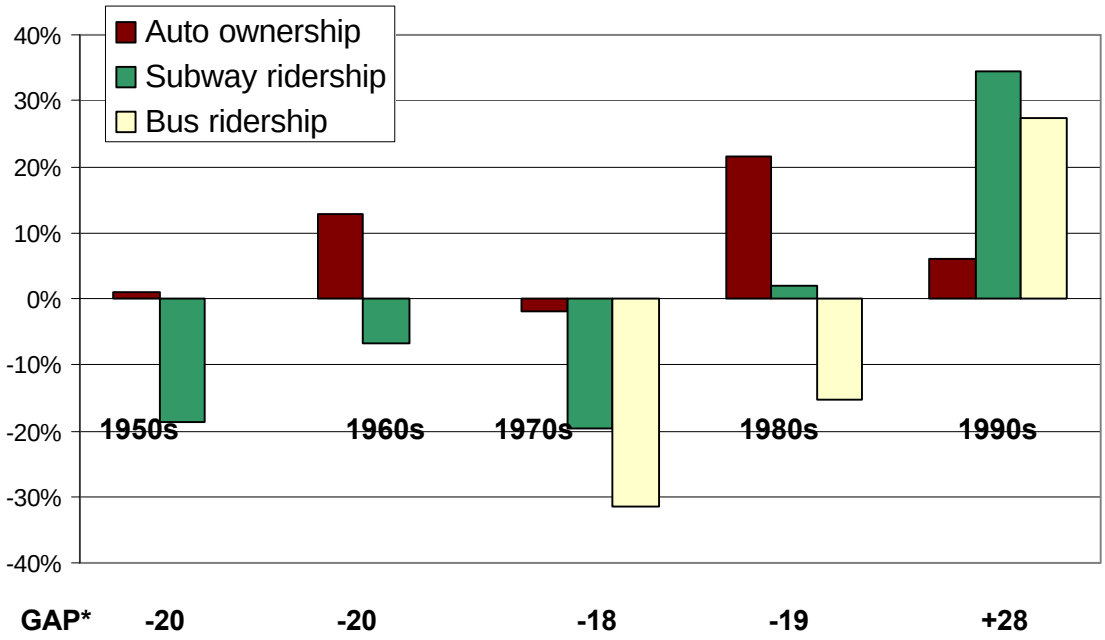
- While in the 1980s auto ownership increased by 21% it grew by only 6% in the 1990s.
- Subway ridership increased by 2% in the 1980s while in the 1990s it expanded by 34%.
- Bus ridership dropped by 15% in the 1980s but grew 27% in the 1990s.

The gap in growth rates between auto ownership and subway ridership switched from 19 percentage points in favor of the auto to 28 percentage points in favor of the subway. The switch between auto and bus growth rates was even more dramatic, from 36 percentage points in favor of the auto to 21 points in favor of the bus. See Figure 3 and Table 1. Table 1 also shows changes in population and employment, which are key drivers of transportation demand.

[6] M.J. Rossmy and S.A. Brown, "Congestion Management in New York City: Managing Why People Drive," *Transportation Research Record 1237* (1989).

Figure 3. Reversal of Modal Growth Trends in the 1990s

Percent change in auto ownership, subway and bus ridership for each decade



* Gap is percent change in subway ridership minus percent change in auto ownership.

Table 1. Modal Growth in New York City, 1950-2000.

	Percent Change in Each Decade					
	Auto ownership	Subway ridership	Bus ridership	Taxi/Livery vehicles	Population	Employment
1950s	1%	-19%	n.a.	21%	-1%	-1%
1960s	13%	-7%	n.a.	38%	1%	6%
1970s	-2%	-20%	-32%	61%	-10%	-12%
1980s	21%	2%	-15%	30%	4%	8%
1990s	6%	34%	27%	30%	9%	4%

Sources: U.S. Census, Department of Motor Vehicles, New York City Transit, New York State Department of Labor, Schaller Consulting. See Appendix A.

How were mode shares for auto, subway and bus trips affected by these modal growth trends?

Estimates of weekday trips for each mode show that transit gained mode share in the 1990s after losing mode share to auto in the 1980s. Auto mode share increased from 41% to 48% of all trips from 1980 to 1990, an increase of 7 percentage points, while the subway lost 3 percentage points to fall to 29% mode share and the bus lost 5 percentage points to fall to a 15% mode share.[7] (See Table 2.)

These trends reversed in the 1990s. The auto lost 4 percentage points in mode share while the subway gained 2 points and the bus gained one percentage point.

Mode share estimates in Table 2 utilize actual weekday bus and subway ridership and an estimate of auto trips. The estimate of auto trips is based on the auto ownership data presented above and the historic rate of growth in trips per auto. These auto trip estimates are consistent with other measures of auto usage such as bridge crossings and vehicle miles traveled, but they should not be viewed as precise figures. (See Appendix B for sources and methodology.)

It is also interesting to note that the overall number of trips taken in New York City increased more rapidly in the 1990s (a 20% increase) than in the 1980s (estimated 9% increase). The higher rate of growth in the 1990s appears due to three broad factors. First is the more-rapid population growth of the 1990s—more people generate more

Table 2. Estimated Mode Shares, 1980, 1990 and 2000, Average Weekday

	1980	1990	2000	Percentage point change 1980-90	Percentage point change 1990-2000
Auto	41%	48%	44%	7%	-4%
Subway	32%	29%	31%	-3%	2%
Bus	20%	15%	16%	-5%	1%
Taxi/Livery	6%	7%	8%	1%	1%
All other non-walk	1%	1%	1%	0%	0%
TOTAL	100%	100%	100%		

Note: Data are not comparable to household travel mode shares shown in Figure 1. Data in this table count each leg of the trip separately, and thus show a higher subway and bus mode share, whereas data in Figure 1are based on only the "main mode." In addition, this table uses actual ridership for subway, bus and taxi trips and an estimate for livery trips based on industry data. Household survey data are used for auto trips (for which there is no other source) and All Other.

School bus trips are not included.

See Appendix B for sources and methodology.

[7] Due to methodological differences, these mode share figures cannot be compared with those for 1963 and 1998 discussed above. See the note in Table 2.

trips. Second, higher income growth experienced by at least some New Yorkers in the 1990s would tend to generate more travel; higher-income households tend to travel more than lower-income households. Third, total travel was stimulated by the particularly rapid growth in subway and bus ridership brought about in part by MetroCard fare incentives.

Six Factors for Mode Shift

Six factors appear to lie behind the mode shift of the '90s. Two of these factors involve public policy decisions aimed at reviving the transit system and increasing its attractiveness to the traveling public. The first of these was the vast capital program that tremendously improved the physical condition of the transit system and the quality of reliability of subway and bus service. The second was introduction of MetroCard fare incentives, which reduced fares and created a more integrated and flexible transit system that more closely approximates the convenience and comfort of private automobiles.

A third vital factor, dramatically falling crime rates and improvements in travelers' sense of safety while riding subways and buses, was the product of public policy and various social trends.

Three other factors contributing to mode shift had a lesser relationship to public policy, at least at the local or state levels. First on this list is the acceleration in immigration to New York City. Many of the new immigrants settled in Brooklyn and Queens neighborhoods and contributed to exceptionally high transit ridership growth in certain neighborhoods. Another factor is increased traffic congestion and scarcity of free or low-cost parking, which directly influences travelers' decision whether to use transit or auto for their trips. Finally, the growing economy, while producing traffic congestion and sprawl in many areas of the nation, contributed to mode shift favoring transit in New York. Commercial and residential revitalization led to increased transit usage in certain densely developed neighborhoods such as Chelsea and Harlem.

Transit Service Quality and Reliability

A necessary though not sufficient prerequisite for the mode shift of the 1990s was the recovery of the subway and bus system, which had deteriorated through budget cuts and neglect in the 1970s and early 1980s. It was a massive effort. From 1982 to 1999, New York City Transit replaced or overhauled its entire fleet of buses and subway cars, restored 530 miles of track, replaced 446 miles of signals and refurbished 110 of the 468 subway stations. At a cost of $24 billion, this effort brought all of NYCT's rail cars, buses and tracks into a state of good repair and paid enormous dividends in the speed, comfort and reliability of subway and bus service.

The effectiveness of system rebuilding and accompanying service improvements can be measured in several ways. One key set of yardsticks shows a thirteen-fold improvement in service reliability. The average distance between subway car failures increased from about 8,000 miles in 1982 to 30,000 miles in 1990 and 111,000 miles in 2000. Average distance between bus service interruptions, which had worsened in the early 1990s, improved after 1995. Transit service became not only more reliable but also more frequent. The spacing between trains, for example, was improved from 10 minutes to 5-8 minutes on many subway routes during off-peak hours. The amount of subway and bus service increased significantly since 1996 in response to surging ridership.

Customer perceptions responded to the renovations and service improvements. In surveys conducted by the Metropolitan Transportation Authority, New Yorkers' overall rating of subway service improved from 3.5 in 1985 to 5.1 in 1990 and 6.3 in 1998, on a zero to ten scale. With the fare incentives now taken for granted and the trains and buses more crowded than ever, the rating slid down slightly to 6.1 in 2000. The bus service rating, first measured at 5.9 in 1996, increased to 6.2 in 1998 and then fell to 5.9 in 2000.

As these data show, improvements in service reliability and customer satisfaction that began in 1982 were spread over the past two decades. Improvements had a modest effect on ridership in the 1980s and auto growth continued to outstrip transit ridership growth. This picture changed as the city emerged from its early-'90s recession. Subway system improvements seemed to reach a critical mass that began to give transit leadership over the auto in mode shares. This can be seen by comparing subway ridership changes with employment changes, to which subway ridership tends to be closely correlated. In 1993 and 1994, subway ridership grew more quickly than employment in the city, exceeding employment growth by 3 percentage points in 1993 and 4 percentage points in 1994. By contrast, in the best year of the 1980s subway ridership growth exceeded employment increases by only 1.2 percentage points. The gains in 1993-94 continued even after the surge in ridership induced by fare innovations in 1997-98. Subway ridership growth exceeded employment increases by 4 percentage points in 1999 and 5 points in 2000.[8]

Crime

Another critical ingredient for mode shift was the drop in crime in the subway system specifically and the city generally. In the 1970s, 1980s and early 1990s, subway and bus customers' concern for their personal security kept many from using transit, particularly outside the rush hour and particularly among occasional riders.

[8] Subway ridership in 1993, 1994, 1999 and 2000 increased by 3.3%, 5.0%, 7.0% and 7.6%, respectively. Employment growth in the same four years was 0.3%, 0.9%, 2.6% and 2.8%.

Two developments transformed both the fact and perception of safety. One was the tremendous drop in reported crime. Felonies committed in the subway declined from 18,000 in 1990 to 4,300 in 2000. Street crime, which affects New Yorkers' willingness to wait at bus stops, followed a similar decline. The second development was the overall improvement in the sense of order in the subway system. Most people tend to deduce the safety of a subway entrance, station or subway car from what they see day to day. Dirt, poor lighting, graffiti, fare beaters, homeless, panhandlers and other signs that no one is in charge of the space convince travelers that this area is unsafe and undesirable. Improvements in the appearance of subway stations, subway cars, buses and bus stops and a marked decrease in homelessness and panhandling made travelers feel safer using transit.

Fare Initiatives

The third factor that powerfully affected mode choice was the fare incentives implemented between July 1997 and January 1999. These included fare discounts, free transfers between bus and subway, and 30-day, 7-day and one-day unlimited ride passes.

The fare incentives produced ridership increases far greater than the most optimistic predictions. Between 1996 and 1999, bus ridership increased by 36% and subway ridership by 16%.

The fare incentives—free transfers and unlimited ride passes in particular—created a more integrated and flexible transportation system. By better approximating the convenience and flexibility of the private auto, the subway and bus system was able to serve trips that would otherwise have been taken by car. Fare incentives particularly bolstered the attractiveness of buses. New Yorkers found that while paying $1.50 for a short bus trip was unappealing, there was great value to the option of taking the bus in connection with a subway trip. The bus could save them a walk of a few blocks. It let them stop short of their final destination, run a few errands and complete their trip without paying an additional fare. It provided options for contingencies; if they found themselves stuck in a subway delay or diverted to a different line, they could exit the subway and hop on a bus. Because of these conveniences, many New Yorkers found themselves studying a bus map for the first time in their lives.

The impact of free transfers particularly benefited from the MTA's unrestrictive transfer rules. Aside from not being able to use the same bus route for a return trip,[9] passengers can transfer between the subway and any bus line, or between any two bus lines, anytime within two hours of starting their trip. Feeling like bargain shoppers at a

[9] The restriction generally covers return trips on the same numbered bus route, and in a few cases, on buses operating on the same street.

never-ending two-for-the-price-of-one sale, New Yorkers enjoyed figuring out how to take advantage of this flexibility.

Unlimited ride passes built on the success of free transfers in attracting discretionary trips that might otherwise have been taken by auto. With a pass, each additional trip is "free," much like car travel. Pricing of the passes makes them attractive to people that make three trips per week or seven trips per month in addition to their daily commute trips.[10] A broad swath of customers finds the passes attractive; 43% of subway and bus trips are now made using 30-day, 7-day or one-day passes.

One sign of the mode shift implications of the fare initiatives is the increase in weekend transit trips. In the 1990s, weekend bus and subway trips, which are primarily for shopping, entertainment and other non-work purposes, increased 49% while weekday trip making grew 29%. Faster growth among weekend trips in the 1990s stands in sharp contrast to the 1980s, during which the number of weekend trips declined more quickly than weekday trips (9% decline weekends vs. 7% decline weekdays).

Immigration

The surge of immigration into New York City in the 1990s transformed neighborhoods and boosted transit ridership, significantly contributing to mode shift. While 23.4% of the city's population was foreign-born in 1980, the figure increased to 28% in 1990. Official Census figures for 2000 have not been released yet, but estimates are the Census will show that about 40% of the city's population was foreign-born in 2000.[11]

Immigration, which began to surge in the early 1990s, was 32% higher during 1990-94 than the immigrant flow in the 1980s. Immigrant settlement was concentrated in Brooklyn and Queens; of the 1990-94 immigrants, 35% of all immigrants settled in Brooklyn, 30% in Queens, 20% in Manhattan and 14% in the Bronx.[12]

While a detailed analysis of immigrants' impact on transit ridership and auto usage awaits release of 2000 Census data on immigration and car ownership, outlines of immigrants' impact can be seen by examining subway ridership and growth in the Asian population. Sunset Park, Brooklyn, which experienced a large influx of Chinese immigrants in the 1990s, provides a striking illustration. The Asian population in Sunset Park increased by over 18,000 persons in the 1990s, concentrated in the southern part of the neighborhood. In 11 census tracks around the 8 Avenue and Ft. Hamilton

[10] These breakeven points assume five workdays in a week and 20 in a month, and that the alternative is to buy MetroCards using the 11-for-10 discounted price of $1.36 per trip.

[11] Estimate by Andrew A. Beveridge, a sociologist at Queens College based on a 1999 survey of New York City households conducted by the Census Bureau. See B. Lambert, "40 Percent in New York Born Abroad," *New York Times* (July 24, 2000).

[12] New York City Department of City Planning, *The Newest New Yorkers 1990 – 1994* (1996).

Ave. stops of the Sea Beach N line, the Asian population increased by 10,517 persons, a gain of 143% from 1990. Subway ridership at these two stations increased 50% in the 1990s after dropping 8% in the 1980s.[13] Similarly, ridership at stations in Sunset Park on the Fourth Avenue N,R line between 36 St. and 59 St. increased by 33-61% in the '90s. A combination of Hispanic and Asian population growth appears to be behind this growth. (See Table 3.)

A similar convergence of subway ridership increases and Asian immigration is evident on a more modest scale elsewhere in Brooklyn. Ridership at the 50 St. and Ft. Hamilton Parkway stations on the West End line (served by B and M trains), for example, increased by 23% or more in the '90s after dropping 15% or more in the '80s. In Queens, above-average ridership growth in certain stations in Astoria, Woodside and Corona appears to be associated with high levels of immigration. (See Table 3.)

Traffic Congestion

Increases in traffic congestion and the cost and unavailability of parking contributed to the mode shift of the 1990s. The most comprehensive available data on traffic congestion shows dramatic increases in the 1990s in the New York metropolitan area. According to a Texas Transportation Institute study, 64% of rush hour freeway travel was on congested highways in 1999 compared with 47% in 1990 and 21% in 1982. Motorists are even more likely to be stuck in traffic on major arterials, with 78% experiencing congestion.[14] While separate data are not available for the city, these figures likely reflect rapid increases in traffic congestion in the city as well as suburbs.

While congestion annoys motorists and may prompt them to consider transit alternatives, parking costs more acutely affect the auto vs. transit mode choice decision. This has been shown nationally[15] as well as locally. A study of mode choice among New York City residents who consider both subway and auto for their travel found that availability of parking is the most frequently named reason to take the subway and leave the car at home.[16] New Yorkers often decide whether to take transit or drive based on their expectation of finding free or low-cost metered parking, particularly for trips into Manhattan from other boroughs.

[13] The comparable citywide subway ridership changes are a 1.0% increase in the '80s and a 37.3% increase in the '90s. These station-specific data exclude student ridership.

[14] Texas Transportation Institute, *2001 Urban Mobility Study*, at http://mobility.tamu.edu/

[15] See K.J. Dueker, J.G. Strathman and M.J. Bianco, *Strategies to Attract Auto Users to Public Transportation*, Transit Cooperative Research Program Report 40, 1998; and Charles River Associates, Inc., *Building Transit Ridership*, Transit Cooperative Research Program Report 47 (1997).

[16] B. Schaller, "Enhancing Transit's Competitiveness, A Survey Methodology," *Transportation Research Record 1669*, Transportation Research Board (1999), available at http://www.schallerconsult.com.

Table 3. Subway Ridership Growth at Selected Stations in High-Immigration Areas

				SubwayRidership			RidershipChange	
Boro	Line	Station	Served by	1980	1990	2000	1980-1990	1990-2000
Sunset Park, Brooklyn								
Bklyn	Sea Beach	Ft. Hamilton Pkwy.	N	1,011,169	765,068	1,069,077	-24%	40%
Bklyn	Sea Beach	8 Ave.	N	912,480	1,004,195	1,586,858	10%	58%
Bklyn	4 Ave.	59 St.	M,N,R	1,557,051	1,701,066	2,418,402	9%	42%
Bklyn	4 Ave.	53 St.	M,N,R	1,077,444	1,445,452	1,916,892	34%	33%
Bklyn	4 Ave.	45 St.	M,N,R	1,033,350	1,303,709	1,840,237	26%	41%
Bklyn	4 Ave.	36 St.	M,N,R	1,820,499	1,621,741	2,607,952	-11%	61%
Other Brooklyn Stations Affected by Immigration								
Bklyn	Brighton	Ave. U	D	1,591,363	1,239,492	2,044,001	-22%	65%
Bklyn	Culver	Bay Pkwy.	F	107,564	160,011	327,453	49%	105%
Bklyn	Sea Beach	Ave. U	N	512,701	299,834	553,234	-42%	85%
Bklyn	Sea Beach	Kings Highway	N	881,347	567,606	840,529	-36%	48%
Bklyn	West End Line	50 St	B,M	982,660	771,198	946,534	-22%	23%
Bklyn	West End Line	Fort Hamilton Pkwy.	B,M	1,013,201	859,988	1,081,960	-15%	26%
Queens Stations Affected by Immigration								
Qns	Queens Blvd.	Northern Blvd.	G,R	1,206,608	1,175,856	1,953,789	-3%	66%
Qns	Queens Blvd.	Elmhurst Ave.	G,R	1,954,680	2,179,377	3,568,940	11%	64%
Qns	Flushing (Queens)	103 St.-Corona Plaza	7	2,096,513	2,914,145	4,557,808	39%	56%
Citywide Total				**951,940,173**	**961,859,855**	**1,320,804,764**	**1.0%**	**37.3%**

Note: station-specific data (and total shown here) excludes students.

While data on parking availability and cost is scarce, a recent study found that parking costs increased 30% in the last five years at Midtown Manhattan garages and 29% in Downtown Manhattan.[17] These increases presumably also reflect more difficulty finding on-street parking in Manhattan (where any is available). Many outerborough neighborhoods are probably experiencing the same trend. Scarcity of free or low-cost parking thus contributes to mode shift from the auto to the subway and bus.

Economic Growth

Economic growth does not necessarily contribute to mode shift and in some circumstances fosters more auto use and less transit use. If the growth of jobs, shopping and entertainment opportunities occurs in areas that are not well served by transit, growth can simply produce traffic congestion, as many sprawl-prone suburban areas of the country have experienced.

Within New York City, however, much of the development activity of the 1990s occurred in locations with excellent transit service and resulted in increased transit ridership. One striking example is the Chelsea area of Manhattan, which experienced commercial and residential revitalization in the '90s. Subway ridership in the West Teens and Twenties increased at a far greater rate than in nearby neighborhoods or the city as a whole. Ridership increased by 52% to 80% at the 23 St. stations on the 6 Ave. and 8 Ave. lines as well as several other stations in this area. (See Table 4.)

The economy's upswing also aided revitalization of other high-density neighborhoods whose residents tend to rely on transit rather than private autos. Harlem experienced substantial population growth in the 1990s and several subway stations show exceptional ridership increases. Eighth Ave. stations from 110 St. to 135 St. experienced ridership growth as high as 236% in the '90s after declining significantly in the '80s.[18] (See Table 4.)

* * *

Each of these six factors appears important in its own right as a cause of mode shift from auto to transit in the 1990s in New York City. Yet the greatest impact may be from the combined and cumulative effects of these forces. Traffic congestion, parking cost and parking unavailability would not have led New Yorkers toward transit if they had felt unsafe waiting on subway platforms or at bus stops. Free transfers and unlimited ride

[17] Colliers International, *Colliers International Parking Survey* (June 2001).

[18] Some of this ridership growth was no doubt due to the crackdown on farebeaters that were forced to pay their way onto the train and thus became counted as "new" riders. However, most of the 1990-2000 increase in ridership at these stations occurred after the reduction in farebeating and thus appears to be truly new subway riders.

Table 4. Subway Ridership Growth at Selected Stations in Areas Undergoing Revitalization

				Subway Ridership			Ridership Change	
Boro	Line	Station	Served by	1980	1990	2000	1980-1990	1990-2000
Selected Herald Square, Chelsea and Union Square Stations								
Manh.	8 Ave.	23 St.	C,E	3,245,839	3,006,672	5,158,328	-7%	72%
Manh.	6 Ave.	23 St.	F	4,250,620	3,700,814	5,762,808	-13%	56%
Manh.	Broadway/7 Ave.	18 St.	1,9	1,143,774	1,400,330	2,526,529	22%	80%
Manh.	Multiple lines	14 St.-Union Square	L,N,R,4,5,6	13,916,763	15,096,468	22,967,540	8%	52%
Selected Harlem Stations								
Manh.	8 Ave./Central Pk. W.	Cathedral Pkwy.-110 St.	B,C	693,955	748,379	1,480,963	8%	98%
Manh.	8 Ave./Central Pk. W.	116 St.	B,C	713,557	331,090	1,112,042	-54%	236%
Manh.	8 Ave./Central Pk. W.	125 St.	A,B,C,D	3,849,013	2,774,589	5,338,523	-28%	92%
Manh.	8 Ave./Central Pk. W.	135 St.	B,C	657,604	357,301	858,228	-46%	140%
Citywide Total				**951,940,173**	**961,859,855**	**1,320,804,764**	**1.0%**	**37.3%**

Note: station-specific data (and total shown here) excludes students.

passes would not have spurred as much ridership growth had riders felt unsafe, if their incomes were declining or if they had fewer shopping and entertainment opportunities conveniently close to transit service. The booming economy attracted immigrants. And underpinning all of these trends was the vast improvement in the condition and reliability of the transit system. Fixing the graffiti-ridden, slow and unreliable subway system in particular was a bedrock precondition for the continuing return of transit and the mode shift from auto travel in New York in the '90s.

Implications

Mode shift in the 1990s represented a major and unprecedented change in mode choice trends that had consistently favored auto travel for four decades. What are the implications of this development for policy-makers in the new century?

One clear lesson is quite simple but important to remember as transportation policy and investment decisions are debated. Public policy and commitment of public funding produced a major change in travel behavior. The choices and commitments of public officials can make a great deal of difference in how New Yorkers use the transportation system.

A second implication of mode shift is that transportation policy is most effective when combined with other supportive changes in the city. In the '90s these ranged from the surge in immigration to commercial and residential development to choking traffic congestion. Rebuilding of the transit system and service and fare enhancements satisfied rising demand for public transportation generated by these changes. Thus, in evaluating alternative transportation investments, it is vital to consider how transportation improvements can capitalize on social and other changes in the city (e.g., immigration, or perhaps aging of the population). It is also vital to consider how transportation investments can dovetail with other public policies such as land use policies.

Consideration of potential synergies by no means dictates which major capital investments should be made, however. Investments can address different types of needs and opportunities such as the need to relieve overcrowding on the Lexington Avenue subway line, or opportunities such as rail extensions to serve West Side office development. But it is useful to focus the debate over system expansion on the question of which needs and opportunities are most compelling and most desired.

Third, the mode shift of the 1990s shows that improvements to existing service are just as important as system expansion. Mode shift came about because transit investments focused on the needs of the time—service reliability, personal safety, comfort and fare integration. Slippage in customer satisfaction ratings in 1999 and 2000 suggests the

importance of continuing to meet service challenges. Successes of the 1990s breed new challenges that must be met to continue recent progress.

The most critical current need appears to be overcrowding brought about by the extraordinary growth in ridership of the last few years. According to MTA surveys, this is now the number one problem cited by subway and bus customers. Additional service, on top of substantial recent increases, would relieve overcrowding and shorten waits for trains and buses.

The transit system also has several opportunities that could become the next MetroCard in terms of impact on the strength and attractiveness of the transit system. One opportunity is to dramatically increase bus speeds. The surge in bus ridership in the '90s should not obscure the fact that New York City buses remain the slowest in the nation. Speed of travel is a key factor affecting the attractiveness of any mode of travel. Improved speeds would greatly strengthen the appeal of bus travel.

Another opportunity is expanded use of technology to give subway and bus customers better information about service. This includes schedule information, waiting time for the next bus or train, delay and diversion information, and even simple information on-route such as provided by the electronic strip maps and LED displays showing the line, time and next station in the new IRT cars. The public increasingly expects real-time information on everything from package delivery to airline delays. Similar transit information would strengthen train and bus service.

Appendix A. Modal Growth Methodology

Table 1 and Figure 2, showing modal growth trends from 1950-2000, is based on the following data:

	Auto ownership	Subway ridership	Bus ridership	Taxi/Livery vehicles	Population	Employ-ment
1950	1,248,825	1,660,098,000	N/A	11,787	7,891,957	3,590,800
1960	1,261,771	1,348,921,000	N/A	14,287	7,781,984	3,538,400
1970	1,422,571	1,257,569,124	947,035,504	19,787	7,894,862	3,745,500
1980	1,395,891	1,009,332,713	647,746,699	31,787	7,071,639	3,301,700
1990	1,695,913	1,028,305,701	548,528,549	41,387	7,322,564	3,566,200
2000	1,799,870	1,381,078,913	698,898,863	53,987	8,018,000	3,720,600

Sources and methodology

Auto ownership

- Number of automobiles and other motor vehicles owned by city residents.
- Sources: Data for 1960, 1970, 1980 and 1990 from the U.S. Census question concerning vehicles "kept at home for use by members of your household."
- No auto ownership question was asked on the 1950 Census; the 1950 figure in the table is based on the percentage change in vehicle registrations in New York City between 1950 and 1960, cited in Regional Plan Association, *Automobile Ownership in the Region, 1960-1970* (1974). The percentage change in vehicle registrations is then applied to the 1960 Census figure.
- 2000 Census data have not been released; the 2000 figure above is based on percentage changes in vehicle registrations in New York City since 1990. In 1992 the NYS Department of Motor Vehicles (DMV) changed its method of reporting auto registrations from total annual registrations to registrations in force, which is a snapshot of registrations as of a given date. The old method included duplicate registrations for the same vehicle and partial-year registrations. The two data series are not compatible. To calculate the change in registrations between 1990 and 2000, the percentage change in total registrations between 1990 and 1994 is combined with the percentage change in registrations in force between 1994 and 2000. This is then applied to the 1990 Census figure. (The year 1994 is used because total registrations for 1992 appear to be erroneously low and total registrations are not available for 1993.)

Subway and bus ridership

- New York City Transit annual subway and bus ridership, including students.

- Source: New York City Transit. Note that the 1980 figure is affected by the transit strike of that year.

Taxi/livery vehicles

- Number of taxicab and livery (car service and black car) vehicles.
- Sources: Data for 1990 and 2000 from Taxi and Limousine Commission. Earlier years based on table found at http://www.schallerconsult.com/taxi/newfb/size.htm

Population

- New York City population
- Source: U.S. Census.

Employment

- Nonagricultural employment in New York City
- Source: NYS Department of Labor. See http://www.labor.state.ny.us/html/nonag/search.htm

Appendix B. Mode Shares Methodology

Table 2, showing mode shares from 1980-2000, is based on the following data:

Estimated average weekday trips in NYC			
	1980	1990	2000
Auto	4,559,328	5,770,624	6,380,136
Subway	3,520,000	3,488,000	4,522,000
Bus	2,175,000	1,787,000	2,267,000
Taxi/Livery	704,403	899,516	1,149,452
All other non-walk	163,819	178,465	213,319
TOTAL	11,122,550	12,123,605	14,531,908

Sources and methodology

Auto ownership

- Starting point is weekday auto trips in New York City, by residents of the New York metropolitan area, in 1997, as measured by the 1997/98 Household Interview Survey conducted for the New York Metropolitan Transportation Council and North Jersey Transportation Planning Authority.
- This figure is then increased for 2000 and decreased for 1990 and 1980 based on two factors:
  (1) Change in number of automobiles from Appendix A.
  (2) Annual growth rate of 0.41% trips per auto between 1963 to 1997, based on household travel surveys.

Auto trip growth was checked against other data sources on traffic growth that are somewhat although by no means exactly analogous to NYC auto trips. Estimates of auto trips in the table below are in the midrange of two other indicators, Vehicle Miles Traveled (VMT) for the NYC area and bridge and tunnel traffic volumes for intra-NYC travel. The second column in this table adjusts auto trip growth for growth in trip length; this is more analogous to VMT and to some extent bridge and tunnel traffic counts.

Change in traffic volumes				
	Auto trips (estimated above)	Auto trips + est. growth in miles/trip	NY area Vehicle Miles Traveled*	NYC Bridge & Tunnel Traffic Volumes**
1980-1990	25%	30%	38%	20%
1990-2000	11%	14%	17%	11%

* Vehicle Miles Traveled (VMT) for the NYC area, which includes the five boroughs of New York City, Nassau, Suffolk, Westchester, Rockland and Putnam counties. Source: NYS Department of Transportation. Periods covered are 1981-90 and 1990-1999. Later and earlier data are not available.

** Bridge and tunnel traffic volumes. Figure is for bridges and tunnels within NYC (does not include Hudson River crossings). Source: NYC Department of Transportation, *Bridge Traffic Volumes, 1999*. Periods covered are 1980-90 and 1990-1999. Later data are not available.

Subway and bus ridership

- Data are from New York City Transit, for average weekday ridership including students. The 1980 figure is adjusted to exclude effects of the transit strike of that year.

Taxi/livery vehicles

- Taxi ridership is based on data found at http://www.schallerconsult.com/taxi/newfb/riders63.htm
- Livery ridership based on number of vehicles and author's estimate of trips per vehicle.

All other non-walk

- Includes bicycle, skating, charter bus. Excludes walk-only trips.
- 1997 figure is based on 1997/98 Household Interview Survey conducted for the New York Metropolitan Transportation Council and North Jersey Transportation Planning Authority.
- Estimate assumes mode share is constant for this category.

Other Publications

This and other reports listed below are available at www.schallerconsult.com

Travel in the New York - New Jersey Metropolitan Area - Summary of results from a 1997/98 household travel survey conducted by the New York Metropolitan Transportation Council and North Jersey Transportation Planning Authority.

Large City Transportation Issues – Explores critical large city transportation issues concerning inter-jurisdictional cooperation in traffic management, interagency sharing of fiber optic networks and fostering walkable cities.

Transportation Issues for 2001 NYC Campaign - A run-down of New York City transportation issues that candidates for Mayor and City Council will or should address in 2001 elections.

Building Effective Relationships Between Central Cities and Regional, State And Federal Governments – Relationships and processes that have proven successful for intergovernmental cooperation, coordination and collaboration in urban transportation systems.

Mustering Support for Transit Investment in the New York Area – Development of a New York City-area coalition's outreach and public education campaign.

Enhancing Transit's Competitiveness: A Survey Methodology – Methods and results from a New York City Transit study.

Lessons from MetroCard Fare Incentives – Why ridership surged more than expected.

Taxi and Livery Crashes in New York City, 1990-99 – Taxi crashes are down, livery crashes are up, but it's more dangerous to be in the back seat of a cab when there is a crash.

Elasticities for Taxicab Fares and Service Availability – How taxi fare increases affect trip demand and the availability of taxi service

Cab Availability and Ridership, 1990-99 – Ridership is at record levels but cabs are harder to find.