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ABSTRACT

The privatization of the New York City subway is proposed. Each line should be operated separately. The operator should pay a fixed price for the capital associated with the line and bid a profit share to be paid to the city. Statistics suggest the New York City subway is operated similarly to other subways and that similar benefits would be realized by the privatization of other subways. We provide an upper bound on the competitive fare which compares favorably with fares charged by buses and taxis.

KEY WORDS: New York, privatization, subway.

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1. INTRODUCTION AND BRIEF HISTORY OF THE NEW YORK CITY SUBWAY

New York City did not always have a unified subway[1] run by a public agency. The first subway was privately funded and operated, but was subject to public oversight. The conflict between private incentives and political interests is well demonstrated by the subsequent history. Limited oversight grew into total control. By 1940, the bankrupted private lines were bought by the city. Accompanying the increase in political control was a deterioration in service quality. When it opened in 1904, the New York City subway system was ranked as the world's best; by 1980, it was possibly the world's worst. Both private and public interests have conspired to ensure that the system has never been competitive. This paper presents a plan - 100 years too late - so that the city's subway can benefit from the presence of competition and from the removal of politically motivated decisions.

In 1891, the city created a semi-independent agency - the Rapid Transit Commission - to help bring subways into existence.[2] In keeping with the contemporary laissez-faire spirit, the Commission was to facilitate the creation of the subway. It was explicitly prohibited from building the subway itself and from regulating the private operator. After preparing plans for two lines, it solicited bids, but no bid was received. Believing that the problem lay in the financial risks of the project, the Commission arranged for the city to put its credit behind the venture and to retain title to the subway. The private operator was to lease for fifty years the building and management of the line and had an option to renew for a further twenty-five years. The Interborough Rapid Transit Company (IRT) was awarded the contract and in 1904

the first subway train travelled from City Hall to 145th Street. It was an instant success.

The elevated railways were the natural competitors of the subway. The first "el" had opened in 1870 and other elevated railways quickly followed. However, by 1900 all companies had been consolidated into three companies - (in Manhattan) the Manhattan Elevated Railway Company and the Metropolitan Street Company, and (in Brooklyn) the Brooklyn Rapid Transit Company (BRT). In 1903 the IRT acquired the Manhattan Elevated Railway Company. In 1905 the IRT merged with the Metropolitan Street Company so that rapid transit in Manhattan was consolidated into a single provider. In 1907 the Governor of New York responded to the perceived lack of competition by replacing the Rapid Transit Commission with the Public Service Commission. Whereas the former commission was confined to promoting the building of the subway system, the latter had the power to investigate complaints, establish rates and order scheduling changes.

The great success of the first subway phase under the IRT created the desire among the city population for a larger system. In 1911 the Brooklyn Rapid Transit Corporation proposed to build subway lines in Manhattan and to connect them to its elevated network in Brooklyn via an existing bridge and a new tunnel under the East River. The Public Service Commission welcomed the proposal, partly because of the line expansion and partly because of the promised increase in competition. Negotiations with the IRT and BRT as to the nature of the enlarged system led in 1913 to the "dual contracts:" the IRT was to enlarge its system and the BRT was to build a second system. Both systems were to be operated by the companies under a forty-nine year lease from the city and the city was to contribute $69 million to the costs. The contracts

included the important provisions that the city's debt was subsidiary to the company's and that the city would share in any profits. The revenues of each company from its new lines were to be pooled with the revenue from its pre-existing lines. After deduction of expenses, the company was to receive preferential payment equal to its pre-existing profit; the city was then to receive interest on its investment. Any remaining profit was to be shared equally between the company and the city. A second important provision was that the fare was to be fixed at a nickel. With the city being the subsidiary creditor and the fixed fare limiting revenue, the city received only $2 million under the dual contract. The taxpayer paid the interest on the city bonds.

The Public Service Commission insisted that the nickel fare be written into the agreement to protect the public interest from the presumed market power of the transit companies. The IRT and BRT agreed because they assumed that prices, which had been steady for decades, would remain steady. However, rapid inflation started in 1916 and by 1920 the real value of the nickel had been halved. Unfortunately, coinciding with the inflation was the election of the populist mayor "Red Mike" Hylan, who made the retention of the nickel fare the supreme political issue: "My policy has been the preservation of democracy and decency, and the retention of the five-cent fare." There was to be no fare increase until 1948.

The post-World War 1 price surge ended in 1920 and inflation was followed by minor deflation. Both the IRT and the BRT - now renamed the Brooklyn-Manhattan Transit Company (BMT) - were able to continue operating by lowering wages and eliminating jobs: for example, multiple-unit door controls reduced manning from six to two operators per train and the introduction of

the turnstile eliminated the need for a ticket-chopper at the gate. The two transit companies also sought to reduce costs by cut-backs in train scheduling, deferred maintenance and limited reinvestment. Quality fell. IRT President Hedley remarked: "I saw a car with clean windows today and when I got back to the office I raised hell to find out who cleaned those windows and spent all that money."

With falling quality, public opinion moved against the transit companies. Hylan reflected the public mood and proposed that the transit system be expanded, not by the expansion of the two pre-existing companies, but by a completely new, municipally-owned company, the Independent Subway (IND). Hylan declared that it was to be a subway "planned, built and operated to accommodate the transportation needs of the people...and not solely for the financial advantage of the operating companies or their officials." In 1923, the New York City Board of Transportation was established with full authority to construct and operate a subway. To mollify upstate legislators the bill specified that after a transition period of three years the fare was to be set high enough to cover the full operating costs. Upstate legislators wanted operating costs to be paid by the riders, not by general taxpayers. Construction started in 1925 and the new line was opened in 1932. However, the politicization of the "nickel fare" caused the transition period for the fare raise to be extended until 1948.

The city now had three different subway systems. The lines had different specifications, stations did not interconnect, there were no free transfers, and each company printed maps which either slighted or ignored the lines of its competitors. The legacy of this arrangement may be still seen: trains using the former BMT and IND lines are too wide to operate in the

former IRT tunnels, many stations which are physically close do not interconnect, and the New York City Transit Authority maps still slight the lines of the PATH subway system with which it connects. The travelling public preferred a unified system and the city estimated that a unified system could achieve significant economies of scale. Mayor La Guardia declared: "Transportation of this kind must be under a single management." However, the forty-nine year leases of the two independent companies prevented unification.

IRT had paid its last dividend in 1919, but continued to operate until 1932 when it entered receivership. Although the start-up of the IND line reduced the market share of the private lines, the BMT continued to pay modest dividends until the 1937 recession. In 1939, the city bought the two companies for $326 million. Unification was in name only as the three systems continued to be operated separately.

After World War 2, rapid transit ridership temporarily rose, reaching its all-time peak of 2051 million riders in 1947. During this period, transit labor was steadily winning concessions, including higher wages, dues check-off and collective bargaining rights, so that the transit system made an operating loss. In 1948, the fare was raised to ten cents. After earning a modest surplus in 1949, the deficit returned in 1950. Seeking to stem the growing stream of deficits and in line with contemporary thinking that the creation of an independent agency would purge politics from public decision-making, the state in 1953 transferred responsibility for subways from the Board of Transportation to a newly created agency, the New York City Transit Authority. The basic structural problems remained, declining ridership, operating deficits, massive capital requirements and powerful unions seeking to benefit their members at the public expense. The creation of the new agency shifted

responsibility for these difficulties, but did not solve them. Most importantly, unlike the Port Authority of New York and New Jersey and the Triborough Bridge and Tunnel Authority, the agency did not inherit a revenue stream at the controlled fare sufficient to cover its expenses. The agency remained financially dependent on the city and the state.

The construction of the IND marked the last major expansion of the subway system. In consequence, there has been an increasingly poor fit between a static system and a dynamic metropolis. For example, the high density of stations centered around Greenwich Village reflect the earlier needs of the area as a manufacturing and employment center, not its current needs. As shown in Figure 1, large parts of Queens and Brooklyn that were developed after 1935 have no subway connections. The subway has remained a city system and was never extended into the suburban communities beyond the city line. There is still no direct link with the city's two airports.

In the 100 years since the creation of the Rapid Transit Commission, the New York City subway has moved from being a private company backed by public credit to being a full public agency. Accompanying this shift has been an increase in the real fare. After correcting for price inflation[3] the real value in 1990 of the 1913 nickel fare is $.70; the 1990 fare is $1.15. In addition to the rider paying an increased real fare, the taxpayer is also contributing massive subsidies: 1990 subsidies on operations were $1,352 million,[4] and capital commitments required additional finance from the taxpayer of $830 million. In total, this constitutes a tax burden of $770 per household per year or $1.50 per trip.[5] These numbers are cause for concern. Of equal concern to the rider is the low quality of a subway journey.

We believe the basic problem is politicization of transit operating and investment decisions. The consolidation of the Manhattan Elevated Railway Company, the Metropolitan Street Company and the IRT created a monopoly of fixed rail rapid transit. This provided the rationale for the "dual contract" to fix the fare at five cents. The consequent constraints caused by a politically expedient fixed fare and wage inflation led maintenance to be deferred. The fixed fare destroyed the incentive for the companies to invest in quality, or even to maintain quality as our quote by Hedley so eloquently shows. In 1939 the city bought two companies whose capital stock needed urgent upgrading. The fixed fare also prevented expansion in that only those lines with very high ridership can be profitable if the fare is set too low. Lines which would have been economic at higher prices were not built. The transfer of ownership into the public sector compounded the problems. The incentive to control costs was removed and was replaced by the political need to placate an organized labor force. Running the subway and the buses as a single massive system eliminates consumer choice. Our proposal stresses the need to reintroduce competition - that is, competition between subway lines and competition between subways and other forms of transport - and to eliminate populist political pressures on service and investment decisions.

2. PERFORMANCE COMPARISONS

Table 1A compares the New York City subway with the other eleven U.S. subways, ranked by size. Two subways exist in the New York metropolitan area. The huge subway operated by the New York City Transit Authority (NYCTA) is the focus of this paper. In addition, there is a smaller subway - the Port

Authority Trans Hudson (PATH) subway operated by the Port Authority of New York and New Jersey - which runs under the Hudson River to connect southern Manhattan with the cities of Newark, Jersey City and Hoboken in New Jersey. Similarly, there are two subways in the Philadelphia metropolitan area: SEPTA runs inside the city whereas PATCO runs under the Delaware River to connect Philadelphia with southern New Jersey.

(TABLE 1A HERE)

Table 1A makes clear that the New York City subway (NYCTA) dwarfs the other systems. NYCTA comprises 36% of the total route miles and approximately 60% of all passengers, vehicles and employees.

(TABLE 1B HERE)

Five systems pre-date World War 1 and the remaining seven systems have been built since World War 2. As shown in Table 1B the older systems have older fleets. The older systems also have shorter distances between stations and shorter passenger journeys. This is because the cities they serve have higher population densities and the subways have less suburban mileage. They run at slower speeds, partly because of the shorter distances between stations and partly because the signalling is older and inefficient. Finally there is the noticeable difference in manning levels: the trains of the older subways use two operators per train, whereas the trains of the newer subways use a single operator.[6]

(TABLE 2 HERE)

Table 2 shows the break-down of operating expense by function and by operating class. The table represents a "typical subway," and has been constructed by weighting the contribution of each subway by its share of total operating expenses. Vehicle operations account for 27% and maintenance

accounts for 40% of the operating expense - station personnel are included in general administration. Transit agencies do not use conventional accounting procedures; for example, operating expenses are only cash expenses associated with operating the system and therefore exclude the "economic cost of capital," that is, interest and depreciation expenses. Labor costs account for 77% of operating expenses as defined by transit agencies.

(TABLE 3 HERE)

Subways are designed to move people, so that an appropriate output measure is passenger miles. Relevant inputs are vehicle hours, track miles, the number of stations and labor. Table 3 compares the U.S. subways by operating performance. The needs of each city are unique, so that each subway operates in a different environment and the comparisons are only suggestive. Subways have been divided into three groups, the subways which pre-date World War 1, and the large and small subways built since World War 2. Because of the city's high population density, the New York City (NYCTA) subway has the highest passenger miles per track mile.[7] The short distance between stations causes the New York City (NYCTA) subway to have an intermediate value of passenger miles per station. The small systems built after World War 2 have low track and station usage. For vehicle usage, New York City (NYCTA) has the lowest passenger miles per vehicle hour, and passenger miles per vehicle hour are noticeably higher for all subways built after World War 2: speed is an important determinant of usage. For labor usage, New York City (NYCTA) has the highest values of passenger miles per operating employee for the older subways, but the newer systems (excluding Cleveland and Baltimore[8]) have higher values or better labor usage. Overall, New York City (NYCTA) has an

intermediate value for operating cost per passenger mile - and the large newer systems have the lowest values.

(TABLE 4 HERE)

The low passenger miles per vehicle hour for New York City (NYCTA) reflects its lower speed,[9] but two idiosyncratic factors partly offset this effect and suggest that New York City (NYCTA) should have high passenger miles per vehicle hour. First, passenger loading in New York is less concentrated in peak periods. Table 4 compares the number of vehicles used during the peak period as a fraction of base vehicle usage: low values correspond to more even vehicle usage. Comparison of ridership patterns for the New York City NYCTA and PATH subways (shown in Appendix A) also confirms that the ridership on the NYCTA subway is less peaked by time of day.

(FIGURE 2 HERE)

Secondly, the flow of passengers in each direction at any time is more equal on the New York City (NYCTA) subway than for other subways. Figure 2 compares passenger flows on the New York City NYCTA and PATH subways: the ratio of inbound to outbound passengers in the morning and the ratio of outbound to inbound passengers in the evening are noticeably smaller for the NYCTA subway than for the PATH subway. The more even passenger loadings, both by time of day and by direction, favor higher passenger miles per vehicle hour.

(TABLE 5 HERE)

Table 5 shows the change in some variables over the ten years 1980-90. The change in route mileage during the decade shows that Washington and Atlanta continued to build their systems and that Miami and Baltimore opened new systems. New York City showed a significant (19%) increase in passenger miles, whereas Boston achieved a stunning (66%) increase. These increases were

almost certainly due both to employment increases in the cities and to the increased quality of the journey. During the decade New York City (NYCTA) improved and cleaned its fleet[10] and Boston placed great emphasis on station modernization, customer service, marketing, and improved information. All the older subways, except New York City (PATH),[11] managed to use their fleets more intensively and to modernize their fleets - fleet sizes and fleet ages fell.

Summarizing, the New York City subway (NYCTA) dwarfs the other U.S. subways - it corresponds to 58% of all passenger miles travelled. It is an old system - its fleet is relatively old, the distances between stations is approximately half that of the subways built since World War 2, and its trains travel at the slowest speed. In consequence, it has the lowest passenger miles per vehicle hour. The operating disadvantages of its age is offset by the high demand caused by the city's high population density. New York City (NYCTA) has high ridership per track mile and per station. For labor usage, New York City (NYCTA) has the highest passenger miles per operating employee of the subways which predate World War 1, but the subways built since World War 2 have significantly higher passenger miles per operating employee. Overall, because labor is such a high proportion of costs, New York City's (NYCTA) operating cost per passenger mile compares favorably with the older subways, but is significantly higher than the newer subways. Because of its large size, we choose to focus on the privatization of the New York City (NYCTA) subway. However, the above discussion suggests that New York is not an outlier. Similar benefits are expected from the privatization of the other subways combined with competition in rapid transit.

3. WHY PRIVATIZE?

The incentives of the market differ to those of politics. Private firms have a strong incentive to control costs. Competition between carriers causes the lower costs to be passed onto the consumer as lower prices. Similarly, as customer satisfaction is the sole source of profits, the private firm has a strong incentive to enhance the quality of service. In contrast, a monopolized agency has little incentive to control costs or to respond to consumer demand for higher quality.

The economic price of a subway ride includes not only the fare paid at the turnstile, but also the taxes required to pay all subsidies. As noted in the Introduction, in 1990 the New York City (NYCTA) subway made an operating loss of $1,352 million - this loss was funded by the taxpayer. However, the operating loss is only part of the economic price paid by the taxpayer. Although the transit authorities exclude the capital costs of interest and depreciation in their calculation of operating expense, capital *is* a resource with an associated cost: interest is foregone and depreciated capital must be replaced. The taxpayer pays the full cost of capital expenditures. In 1990, capital commitments equaled $830 million. These numbers are large: $2,182 million constitutes approximately 40% of the expenditure on public welfare by New York City.[12] *All* costs of the subway are paid for by households, either as users or as taxpayers.

The first advantage of a privatized subway is that a private subway will control costs because any cost increase comes out of profit. With each subway line run as a separate company and with a number of alternative carriers (buses and taxis), the private subway has limited ability to raise

prices to offset cost increases. In contrast, a public agency has little incentive to control costs. Management and workers know that any increase in labor payments will be funded by increased subsidies from the city and state. Settlements which would bankrupt a private firm may be financed indefinitely from the public purse.

Because state and city finances are complex, the voter has limited ability to recognize the extent to which his taxes are used to finance inefficiency. City-agency political negotiations and not cost-minimization guides wage policy and labor usage. Labor settlements will pay higher wages and will guarantee more jobs than a competitive subway would provide. Because the subways are run as a single system together with the buses, a rider currently faces a near monopoly in transportation. The rider as a voter may be willing to increase the subsidy to transit labor in order to prevent the inconvenience of a system-wide strike. In contrast, with a competitive non-politicized subway system, workers of a particular subway have far less power to transfer income to themselves from the public: if the workers of a particular subway strike, travelers can transfer at modest cost to alternative subway lines and alternative transportation modes.

(TABLE 6 HERE)

The data support the above hypotheses on wages and employment. Transit workers were notoriously well paid relative to the private sector in 1980 (Ramsey (1987)). Table 6 compares the increase in the average hourly earnings of a New York City (NYCTA) subway worker with the increase in the average wage rate. Between 1980 and 1990, wage rates in the city rose 63%, but wages for subway employees rose 89%.

(TABLE 7 HERE)

The resistance to declines in employment is predicted to occur at all public subway systems and not only in New York. While Table 6 shows that most subways (excluding of course the expanding subways of Washington and Atlanta) managed during the ten years from 1980 to 1990 to reduce the labor used in transportation and maintenance, all subways (except Cleveland) simultaneously increased the labor used in general administration. The overall fall in employment was small. For example, the New York City (NYCTA) subway lost 7,103 jobs in transportation and maintenance - a 27% reduction - but created 4,281 jobs in general administration - a 106% increase.

Private management, being more focused than a public agency on reducing costs, will attempt to introduce quickly new working practices. The reader may recall from the history presented in the Introduction that the early subways took several innovative measures to reduce labor costs. Private management will shorten trains in off-peak periods and introduce one-person trains. Although Table 1B shows that all post-World War 2 subways have been built with one-man trains, and although the estimated annual savings are $21 million,[13] only now is a limited trial of these working practices being tried out at the New York City (NYCTA) subway. Although they are the most visible part of the subway, vehicle operations account for only 27% of total operating expenses (see Table 2). Private management will also reduce costs in maintenance and in general administration by introducing new working practices. For example, fare-dispensers at stations will be introduced, saving labor at token booths.

A competitively run subway will reduce costs by better matching of supply with demand. If demand falls, the private firm must reduce supply or make a loss. The political process works against reducing supply to meet a

reduced demand. Voters can extract through the political process a provision of services that they are unwilling to pay for directly. The support of interest groups is bought by taxes on the majority. The difficulty of closing fire-houses in New York City is a well-documented companion example. It was noted in the Introduction that the basic configuration of lines and stations of the New York City (NYCTA) subway is essentially unchanged since construction of the IND line was started in 1925. However the demographics of the city have changed and, in particular, light industry has moved from the area around Greenwich Village. Table 1B showed that station distances in the pre-World War 1 systems are approximately half those of modern systems. A privatized subway will close some stations with low demand. In addition to the direct savings on maintenance and staff, trains will be able to travel faster and fewer vehicles will be needed to maintain existing service levels.

(TABLE 8 HERE)

A similar mis-matching of supply and demand is evident in the current operating hours. A privatized subway will reduce costs by not providing a 24-hour service on every line to every station. Of the post-World War 2 systems, only Philadelphia (PATCO) provides 24-hour service. For example, using the ridership figures in the Appendix, closing the New York City (NYCTA) subway between 1^{00} a.m. and 5^{00} a.m. would affect less than 1 percent of all riders, but would yield significant cost savings. This is because there would be no need to staff trains and stations and because track repair could be undertaken without interruption. Although the subway system would be closed, it is wrong to conclude that people would be unable to travel during these hours: the unsatisfied demand would induce the development of alternative modes of transport - possibly small buses or jitneys.

Not every station on a line needs trains at the same frequency. Inevitably, because the primary flow is to and from the city center, passenger loads on the outer lines are lower. Fewer trains are needed to serve these stations. Again, the political process is not well suited to delivering this frequency reduction - users of the outer stations object politically to prevent the service cut-back and to maintain the uneconomic service paid for through taxes. A privatized subway will reduce costs by reducing the train frequency at the outer stations.

The second advantage of a privatized subway is that competition will cause subways to become focused on the customer's needs and on delivering a product that the consumer is willing to buy. There is a need to invest in quality. As noted in Section 2, the increased ridership on the New York City (NYCTA) subway between 1980 and 1990 is partly attributable to the improved fleet. Similarly, between 1980 and 1990 the Boston subway experienced a 66% increase in passenger miles: a large part of this increase was caused by the agency placing greater emphasis on customer satisfaction.

Although all New York City subway cars are now air-conditioned, it is startling to realize that even in 1985 only 50% were air-conditioned. Unfortunately, the New York City (NYCTA) station experience is still unpleasant: most stations are dirty, security is limited and maps on the stations - as opposed to near the ticket booth - are almost non-existent. Unsurprisingly, the New York City (NYCTA) record on station renovation is unpromising: only 48 stations have been renovated since 1981 and most have been completed behind schedule and over budget. A monopoly provider has little incentive to invest in quality. In contrast, a private subway will seek to gain riders by providing a better service. If it fails to match its services

with its riders' needs, it will loose customers to other lines, and - most importantly - with other modes of transportation. Private management will invest to make journeys faster. Trains will be cleaner. Competition between carriers will completely change the station experience. Stations will be renovated, lighting at stations will be improved, newspaper kiosks will be built and policing will be increased. The installation of automatic fare dispensers will eliminate lines at token booths. Maps will be more available and will stress links with connecting transportation.

Vehicle and station improvements are only part of the improved service consequent on privatization. A customer-orientated subway will attract passengers. New lines and stations will be built where there is sufficient demand - an example is a link to the city's airports. Although the provision of services will be decentralized, services would still be integrated. Competition will guide bus operators to provide feeder services to the subways and to co-ordinate their services with the subways. Most importantly, the profit-motive provides a strong incentive for the development of creative solutions. The great gain is that new transit methods and patterns will develop to meet people's needs both now and as they change in the future.

The third advantage of a privatized subway is that users and not taxpayers would pay the cost of its operation. In contrast, the current arrangement means that a large part of the cost, over 50% of the full economic cost, is paid by taxpayers who often are not users of the subway. Appendix A shows that there are 1.6 million total inbound passengers in a typical day. In contrast, there are 2.8 million households in the city, so that a large number of households pay city taxes to support the subway but do not use it. The

subway also receives considerable state funding,[14] so that upstate taxpayers support the subway although they do not use it.

(FIGURE 3 HERE)

As noted earlier, the subsidies are large, constituting approximately 40% of the public welfare payments made by New York City to poor families. But the main beneficiaries are not poor families. Figure 3 shows that the main users are middle-income households: ridership per household increases steadily with income up to incomes between $\$_{89}35,000$ and $\$_{89}50,000$. For comparison, in 1989 the median household income in the city was $\$_{89}29,000$.[15] The main beneficiaries of the subsidies are middle-income households.

With a competitive subway, each user pays the incremental cost of his journey. Incremental cost varies with the distance travelled and a private subway will charge accordingly. This is a good example of how the outcome achieved by the political process differs from the outcome achieved by the market. Table 8 shows that the fare on many of the newer systems - less regulated because they have been regulated less long - does vary according to distance travelled. However,the New York City (NYCTA) subway is legally prevented from charging fees which vary with distance travelled.[16] The result is that the subway is expensive for short journeys and cheap for long journeys, or there is cross-subsidization from "short journey" riders to long distance riders. The current policy induces price-substitution for short journeys from the subway to other transportation modes - especially taxis. This is particularly important in Manhattan where most of these journeys are likely to occur and contributes to the congestion there.

The literature on peak load pricing shows that incremental cost has two components: the variable cost associated with the journey and an

additional cost associated with the capacity induced by the individual's demand. Subway capacity is determined by travel during the peak periods, so that the incremental cost is higher at these times. The competitive fare of a journey during peak periods will reflect the cost of the induced capacity. The fare should vary according to the time of travel, and the lower off-peak fare will induce increased off-peak ridership. Table 8 shows that currently only the Washington subway charges according to the time of travel.

4. THE PROPOSAL

Our proposal promotes competition while giving the city a silent interest in the subways. Competitive supply ensures low-cost working practices are adopted, that the fare reflects the cost, that facilities are innovatively used and that customer satisfaction is a priority. The subsidy by the city and state is abolished. The link between the subway and the public purse is to be broken.

The proposal is similar to the proposal described by Ramsey (1987). The New York City (NYCTA) subway should be sold to private firms over the next five years. As shown in Figure 1, an unusual feature of the New York City (NYCTA) subway is the high density of lines; each line lies close to at least one other line for a considerable portion of its route, and crosses other lines at many points. This of course is not accidental but a consequence of the development of the original system by three different subway companies.

There are nine well-developed lines and thirteen maintenance facilities. Each line and associated maintenance facilities should be owned and operated by a separate company: this ensures competition between lines.

As indicated in the Introduction, it was the consolidation of the IRT, the Manhattan Elevated Railway Company and the Metropolitan Street Company that prevented the development of competitive rapid transit in New York. Competition should be encouraged between each subway line and with alternative modes of transportation - such as buses, mini-buses, taxis, non-medallion cabs, jitneys and other modes we have not considered. Owners of the subway will not be allowed to also own competing transportation modes, but could own "feeder modes," e.g. mini-buses to deliver passengers to the station.

The sale of each line should proceed in two stages. A price for all the pre-existing capital equipment associated with each line is to be established. This value is to be determined by a panel of evaluators jointly appointed by the city and by the prospective operators.[17] The price is the fixed amount that a firm must pay to buy the existing capital and to buy the right to operate the line.

After the price for the capital equipment is established, there is an auction to determine which firm is to operate the line. At the auction, each prospective operator bids the share of profits it will pay the city. The profits to be shared are "pure profits," that is the profits that will remain after all expenses (including the capital expense of interest and depreciation) have been deducted from revenue. This arrangement is similar to the profit sharing arrangement included in the "dual contracts." The crucial distinction between our proposal and the "dual contract" is that no fare ceiling is imposed: it was the fixed five cent fare which prevented reinvestment by the IRT and BMT and finally led to the takeover by the city.

The profit sharing by the city is desirable, partly because it seems right that the city should benefit if any profits are earned, but more

importantly because it makes the proposal politically feasible. The political reality is that the city would be unwilling to loose all interest in the subway: this arrangement limits their involvement to a financial stake. The city can use its returns in any way it sees fit, including the subsidization of groups and of stations that would otherwise be closed. However, the political aspect of any transfer is clear, and the economics of subway operation are separated from the politics of income transfers.

The ownership of the vehicles and stations and all responsibility for service belong to the operator. The operator may without restriction either invest in a station or close it: usage, not political considerations, must determine the station lay-out. Similarly, the responsibility for the fare and the service frequency at each station is the responsibility of the operator. Although the city shares in profits, it is not a shareholder: the city is to be legally restrained from intervening in any operating or investment decision.

The right of way is retained by the city. The track and associated signalling provide the only complication and their treatment depends on whether the costs associated with maintaining the track are variable or fixed. This is a technical question which needs to be resolved by the evaluators who set the price. If track expenses vary significantly with usage, then the track should be included in the assets transferred to the operator. If, on the other hand, the track expenses are very insensitive to usage, so that it has the characteristics of a public good, the ownership of the track and the responsibility for its maintenance should be retained by the city. But the city would have to commit to carrying out the current plans to upgrade the

track and the expense of such a commitment would have to be financed from general revenues.

5. FARES

What is the likely fare for a journey on a privatized subway? We have already indicated that this question is badly posed - fares will vary by distance travelled and by time of day. However, it is instructive to estimate the average fare under the worst scenario. This provides an upper bound and has the advantage of stressing that our proposal is feasible. The competitive fare will be close to minimum long-run average cost. We have estimated the average cost if the system continues to be operated "as is." It must be stressed that this is a worst-case scenario - the whole motivation for privatization is to unleash the forces which encourage cost reduction, flexibility and quality improvement.

(TABLE 9 HERE)

Table 9 shows actual and expected capital expenditures for the period 1982 - 2001, measured in 1990 dollars. The total capital expenditure for the 20-year period is $\$_{90}10,038$ million for track, and $\$_{90}15,937$ for all other items. Average capital expenditures are therefore $\$_{90}502$ million per year for track, and $\$_{90}797$ million per year for all other items. To calculate the worst possible case, we use these numbers as the depreciation expense. By 1982 the subway had been heavily depreciated, so that in fact the numbers do not refer to normal depreciation, but to depreciation *plus* the cost of restoring the infrastructure to a state-of-good repair. The numbers probably overstate the true depreciation expense by a large amount.[18]

There are two cases depending on whether the decision is to have the city retain ownership of the track.

(TABLE 10 HERE)

Case 1: the track cost is a variable cost. The track is transferred to the operator and an upper bound on total depreciation expenses is $\$_{90}502 + 797 = 1,299$ million. Table 10 shows that a typical investment has a useful life of 30 years. A depreciation expense of $\$_{90}1,299$ million therefore corresponds to a capital stock of $\$_{90}1,299 \times 30 = 38,970$ million. Using a real interest rate of 4%, the interest cost is $\$_{90}.04 \times 38,970 = 1559$ million. The worst scenario for costs is therefore

Operating expense	2,457	($\$_{90}$ million),
Capital cost - depreciation:	1,299,	
- interest:	1,559,	
Total cost:	5,315	($\$_{90}$ million).

Total 1990 ridership was 6,646 million passenger miles: therefore the cost per mile was no more than $\$_{90}.80$. Because all costs are variable, any shrinkage in ridership caused by the higher fare does not affect average cost - service frequency adjusts to the changed demand. Competitive forces drive the fare to average cost. Hence the fare per mile will be no more than $\$_{90}.80$. This is the upper bound for the competitive fare: it is calculated assuming that the subway continues to be operated "as is" and that all current capital expenditures are depreciation expenses.

Case 2: the track cost is a fixed cost. The city retains ownership of the track so that it must pay for its upkeep through general revenues. Total depreciation expenses attributable to the operating company are $\$_{90}797$ million. As before, an asset life of 30 years implies that the capital stock to which this depreciation refers has value $\$_{90}797 \times 30 = 23{,}910$ million. The interest expense is $\$_{90}.04 \times 23{,}910 = 956$ million. A worst-case scenario for costs which are attributable to the operating company is

Operating expense	2,457	($\$_{90}$ million),
Capital cost - depreciation:	797,	
- interest:	956,	
Total cost:	4,210	($\$_{90}$ million).

This cost corresponds to the supply of 6,646 million passenger miles, or a direct cost per mile of $\$_{90}.63$. Hence, if the track is retained by the city and its maintenance requires a subsidy from the city, the competitive fare per mile will be no more than $\$_{90}.63$. This is the upper bound to the competitive fare: it assumes that privatization brings no cost savings and it attributes all current capital expenditures to depreciation.

(TABLE 11 HERE)

Private subways will not be priced out of the market. First, the above fares are the worst-case scenario with the subways being run "as is." However, large cost savings are to be expected. Second, these fares are similar to the prices charged by buses and significantly lower than the price of a taxi.

Table 11 shows the cost per passenger mile for five bus companies in Brooklyn and Queens: the worst-case fares calculated above are similar to these costs.[19] In 1990, the price per mile in a taxi was $1.25, and there was an additional fixed component. Table 1B shows that the average subway journey was 4.5 miles: a taxi journey of this length cost $6.88.

The fare rise consequent on privatization will not cause a large price substitution away from subway travel. The fare is likely to less (similar in the worst-case scenario) than the price of alternative modes of travel; with their dedicated track, subways are faster than buses, and the quality of the privatized subway will be better than the current subway. In addition, 55% of current subway users are either commuting to work or doing other job-related business.[20] This travel is likely to be relatively price insensitive. The remaining 45% of current travel is more discretionary and therefore more price sensitive.

6. CONCLUSION

When the first subway line in New York City opened in 1904, the crowd cheered with enthusiasm and the fare was $.05. However, competitive provision was prevented by merger and by public intervention. Almost 100 years later, in 1990 the fare was $1.15 - a real increase of 64% - and the taxpayer contributed an additional $2.45 per ride.[21] the interest payments due on the capital. f Although quality has improved since the low-point in 1980, it is still much below that of other subways.

This sad state of affairs can be changed. The privatization of the subway to provide a competitive rapid transit system would provide the benefit

of improved quality at a lower cost. Subway fares will reflect incremental costs and will, therefore, vary by length of journey and time of day.

This paper provides a proposal for privatization and stresses that it is feasible. The city will retain a share in any profits, and the fare rise will be moderate - the competitive fare will certainly be less than either $.80 or $.63 per mile depending on whether the operator is made responsible for the track. The funds released from the city and state budget can be used to fund alternative desirable projects.

Perhaps the most persuasive reason for privatizing the subway has little to do with providing better transportation at lower real cost. New York City has been seriously undermaintaining its infrastructure of roads, bridges, sewers and water supply. The needed repairs and rebuilding could be done using the funds which are currently used to subsidize the subway - currently $2.2 billion per year. The proposal is a win-win situation.

APPENDIX A: 1990 ridership flows.

	NYCTA		PATH	
Period	inbound	outbound	inbound	outbound
midnight - 1	4,961	15,309		
1 - 2	2,758	7,549		
2 - 3	1,785	3,475		
3 - 4	1,869	2,576	2,256	2,070
4 - 5	4,032	2,625		
5 - 6	20,947	6,037		
6 - 7	77,828	23,462	5,642	1,347
7 - 8	235,471	61,194	23,234	2,926
8 - 9	378,493	67,350	32,497	4,010
9 - 10	197,183	47,472	11,412	2,001
10 - 11	80,125	34,840	3,968	1,540
11 - noon	60,294	36,633	2,976	1,691
noon - 13	52,209	45,010	2,494	2,071
13 - 14	50,176	50,026	2,291	2,622
14 - 15	55,891	70,162	2,326	3,186
15 - 16	69,490	101,287	2,746	5,437
16 - 17	84,422	180,079	4,334	14,393
17 - 18	74,273	296,093	5,233	27,532
18 - 19	47,671	205,777	2,673	15,744
19 - 20	30,518	117,848	1,298	7,365
20 - 21	21,374	65,837	867	4,459
21 - 22	15,489	45,127	769	3,191
22 - 23	15,088	31,513	678	2,279
23 - midnight	12,135	23,011	460	1,611

SOURCE: *New York City Transit Authority* and *Port Authority of New York and New Jersey documentation.*

APPENDIX B: 1989 income characteristics.

Income range	1989 NYCTA passenger trips per day	1989 household frequency in New York City
$ 0- 10,000	182,028	569,303
$ 10,000- 20,000	593,501	427,015
$ 20,000- 35,000	1,002,006	610,473
$ 35,000- 50,000	830,779	447,953
$ 50,000-100,000	590,352	582,080
$100,000-150,000	116,510	108,061
$150,000-	49,475	71,189

SOURCE: *New York City Transit Authority Documentation. Cendata (1990 CPH-L-81).* Washington, D.C.: Department of Commerce.

REFERENCES:

Hood, C.D., (1986), "Underground politics: a history of mass transit in New York City since 1904," Phd. dissertation at Columbia University, New York.

Ramsey, J.B., (1987), "Selling the New York City subway: wild-eyed radicalism or the only feasible solution ?" In *Prospects for privatization*, edited by S.H. Hanke. Montpelier, VT: Academy of Political Science.

FOOTNOTES.

[1] The term "subway" is used to denote fixed rail rapid transit. The "subway" in New York has parts which are underground, parts which are at ground level, and parts which are elevated.

[2] For an excellent history of the New York City subway, see Hood (1986).

[3] Corrected using the implicit price deflators for gross national product from *Historical Statistics of the United States* and *Survey of Current Business*. Washington: Department of Commerce.

[4] 1990 passenger revenue was $1,105 million, and operating expense was $2,457 million.

[5] In 1989, 2.8 million households lived in New York City (*Cendata*. Washington, DC: Bureau of the Census). In 1990, 1476 million trips were made on the New York City (NYCTA) subway (see Table 1).

[6] Philadephia (SEPTA) uses both 2-man and 1-man trains.

[7] Track miles differ to route miles. Many New York routes have local and express service on different tracks and in both directions: for such routes, one route mile corresponds to four track miles. Also, track miles include yard track whereas route miles include only right of way used for revenue service.

[8] Cleveland has experienced a large ridership fall (see Table 4), and Baltimore and Miami are probably still experiencing start-up effects.

[9] The importance of speed may be examined by considering "passenger miles per vehicle mile:" no pattern emerges.

[10] An indicator of fleet quality is the mean distance between failures. This increased from 6,808 miles in 1980 (the all-time low) to 29,948 miles in 1990 (*New York City Transit Authority documentation*).

[11] The increase in ridership on the New York City (PATH) subway during the decade caused the fleet to be increased. 201 cars were rebuilt instead of

being replaced.

[12] In the fiscal year 1989/90, $5,803 million was spent by New York City on public welfare (*City Government Finances*. Washington, DC: Bureau of the Census).

[13] *Transit Authority Committee Agenda*, February 1992.

[14] In 1990, the New York City Transit Authority received $1.5 billion as operating assistance (i.e. excluding capital funds), of which 57% was provided by local sources, 38% by state sources and 5% by federal sources. (*Transit profiles. Agencies in urbanized areas exceeding 200,000 population. For the 1990 Section 15 Report Year*. Washington, DC: Department of Transportation.) These funds are used to fund both subway and motor bus operations.

[15] Estimated from income tables on *Cendata (1990 CPH-L-81)*. Washington, D.C.: Bureau of the Census.

[16] *Statutory Provisions Affecting The MTA And Its Subsidiaries* (New York, 1967). The provisions, which established the New York Metropolitan Transportation Authority to guide regional transportation, prohibit the agency from introducing without the mayor's approval new fares which vary by zone. Travel to the Rockaway stations was subject to a pre-existing surcharge - a passenger departing or arriving at the Rockaway stations had to deposit an additional token. This surcharge was removed as part of "the deal" which gained approval for the September 1975 fare increase.

[17] It is suggested that the city selects one evaluator, the prospective operators select one evaluator and the two selected evaluators agree on a third.

[18] It should also be noted that these values exceed the 1990 capital committment of $830 million referred to earlier. We are really considering the "worst-possible" case.

[19] The costs shown in Table 11 do include depreciation and interest expenses. Costs not prices are shown because buses - unlike taxis - do not charge on a per mile basis.

[20] The percentage refers to 1989 journeys. *New York City Transit Authority documentation.*

[21] $2.45 is calculated using an average journey of 4.5 miles and a cost of $.80 per mile (see Section 5). $2.45 differs to the tax burden of $1.50 per trip refered to in the Introduction. $1.50 is the tax burden required to finance the operating loss plus the capital committment. As stressed in Section 3, the full economic cost includes the capital costs of depreciation and interest: $2.45 is the total subsidy, which includes the portion of the capital committment estimated to be associated with depreciation, *plusMDNM*

LIST OF TABLES

TABLE 1A: 1990 statistics of U.S. subways.

Subway	Route miles	Passenger miles ('000)	Passenger trips ('000)	Vehicles	Vehicle hrs ('000)	Vehicle miles ('000)	Operating Employees	Operating Expenses ('000 $)
Large								
New York City (NYCTA)	246	6,645,594	1,476,353	5,255	17,012	308,342	27,441	2,457,197
Chicago	96	1,019,255	165,733	924	2,422	56,582	4,294	283,403
Washington	70	994,187	182,006	478	1,482	33,212	3,478	243,472
San Fransisco	71	891,229	74,762	388	1,405	40,328	2,098	186,836
Boston	38	546,477	179,762	320	1,099	23,186	2,707	220,101
Medium								
Philadelphia (SEPTA)	38	407,457	91,841	271	1,018	15,930	1,908	130,177
Atlanta	34	360,042	68,947	138	646	15,609	1,235	62,534
New York City (PATH)	14	278,039	60,678	297	624	12,653	1,312	125,704
Small								
Philadelphia (PATCO)	16	100,117	11,405	96	144	4,036	329	21,550
Cleveland	19	57,513	7,596	38	73	1,828	362	19,472
Miami	21	109,693	13,622	82	179	5,444	452	41,961
Baltimore	13	65,684	13,612	60	162	3,691	485	32,600
New York City (NYCTA) as a fraction of total	0.36	0.58	0.63	0.63	0.65	0.59	0.60	0.64

DEFINITIONS:
Route miles: miles of right of way over which public transportation vehicles travel while in revenue service.
Vehicles: vehicles operated in maximum service.
Vehicle hours: total number of hours for which vehicles are operated in revenue service. Excludes hours consumed while travelling to and from storage facilities.
Vehicle miles: sum of all vehicle miles operated while in revenue service. Excludes miles travelled to and from storage facilities.
Operating employees: employee equivalents working in transportation, maintenance and general administration. Excludes employees working on capital projects.
Passenger trips: a passenger is counted each time he/she enters the rapid transit system.
Passenger miles: the number of miles travelled by all passengers.
Operating expenses: total cash expenses associated with operating the system. Excludes interest payments and depreciation charges.

SOURCE: *Transit Profiles. Agencies in Urbanized Areas Exceeding 200,000 Population for the 1990 Section 15 Report Year* and *Data Tables for the 1990 Section 15 Report Year*. Washington, D.C.: Department of Transportation.

TABLE 1B: 1990 statistics of U.S. subways (continued).

Subway	Average age of fleet (years)	Average distance between stations (miles)	Average passenger journey (miles)	Speed (mph)	Train-manning level	Vehicles per train[1]
Pre-World War 1						
New York City (NYCTA)	18	0.5	4.5	18	2-man trains	8.8
Chicago	14	0.7	6.1	23	2-man trains	6.4
Boston	15	0.7	3.0	21	2-man trains	3.3
Philadelphia (SEPTA)	23	0.5	4.4	16	1- & 2-man trains[2]	4.6
New York City (PATH)	18	1.1	4.6	20	2-man trains	6.3
Post-World War 2 - large						
Washington	9	1.1	5.5	22	1-man train	6.3
San Fransisco	13	2.1	11.9	29	1-man train	7.3
Atlanta	7	1.2	5.2	24	1-man train	6.0
Post-World War 2 - small						
Philadelphia (PATCO)	17	1.2	8.8	28	1-man train	5.1
Cleveland	7	1.1	7.6	25	1-man train	3.8
Miami	8	1.0	8.1	30	1-man train	n/a
Baltimore	5	1.1	4.8	23	1-man train	n/a

[1] 1980 figures. 1990 figures unavailable.
[2] One line uses 1-man trains and one line uses 2-man trains.

SOURCE: Calculation using *Data Tables for the 1990 Section 15 Report Year*. Washington, D.C.: Department of Transportation. *Telephone interviews*.

TABLE 2: 1990 typical operating expenses by function and object class.

Operating expense by function		*Operating expense by object class*	
Function	% operating expense	Object class	% operating expense
Vehicle operations	27	Labor	77
Vehicle maintenance	17	Utilities	8
Non-vehicle maintenance	23	Materials and supplies	7
General administration	33	Casuality and liability	4
		Other	4
	100		100

Numbers constructed as weighted sum of individual subway shares.

NOTE: operating expenses are total cash expenses associated with operating the system, and exclude interest and depreciation charges.

DEFINITIONS:
Vehicle operations: vehicle movement control, scheduling of transport, related administration.
Vehicle maintenance: inspection and maintenance of vehicles, accident and vandalism repair of vehicles, related administration.
Non-vehicle maintenance: inspection and maintenance of facilities, including track, tunnel, bridges, stations, and fare collection equipment.
General administration: station personnel, system security, customer service, market research, safety, personnel administration, legal services, data processing, finance and accounting, purchasing and stores, engineering, real estate, management, office maintenance and services, and planning.

SOURCE: Calculation using *Data Tables for the 1990 Section 15 Report Year*. Washington, D.C.: Department of Transportation.

TABLE 3: 1990 operating statistics of U.S. subways.

Subway	Passenger miles per track mile[1] ('000)	Passenger miles per station ('000)	Passenger miles per vehicle hour	Passenger miles per operating employee ('000)	Operating expense per passenger mile ($/mile)
Pre-World War 1					
New York City (NYCTA)	9,521	14,170	391	242	0.37
Chicago	4,785	7,128	421	237	0.28
Boston	5,060	10,311	497	202	0.40
Philadelphia (SEPTA)	4,158	5,361	400	214	0.32
New York City (PATH)	7,723	21,388	446	212	0.45
Post-World War 2 - large					
Washington	6,541	15,534	671	286	0.24
San Fransisco	4,741	26,213	634	425	0.21
Atlanta	4,138	12,415	557	292	0.17
Post-World War 2 - small					
Philadelphia (PATCO)	1,022	7,701	695	304	0.22
Cleveland	1,369	3,195	788	159	0.34
Miami	2,070	5,223	613	243	0.38
Baltimore	2,053	5,474	405	135	0.50

DEFINITIONS: see Table 1A.

[1] Track miles differ from route miles. Many New York routes have local and express service on different tracks and in both directions: for such routes, one route mile will correspond to four track miles. Includes yard track.

SOURCE: Calculations from *Data Tables for the 1990 Section 15 Report Year.* Washington, D.C.: Department of Transportation.

TABLE 4: 1990 vehicle usage.

Subway	Ratio of vehicles operated in pm peak period to vehicles operated in average base period
Pre-World War 1	
New York City (NYCTA)	1.6
Chicago	2.4
Boston	2.4
Philadelphia (SEPTA)	1.7
New York City (PATH)	2.1
Post-World War 2 - large	
Washington	2.6
San Fransisco	2.2
Atlanta	1.4
Post-World War 2 - small	
Philadelphia (PATCO)	8.0
Cleveland	3.0
Miami	2.7
Baltimore	2.1

SOURCE: *Data Tables for the 1990 Section 15 Report Year.* Washington, D.C.: Department of Transportation.

TABLE 5: 1980-90 changes.

Subway	Route miles		Passenger miles ('000)			% change in city labor force 1980-1990	Vehicles			Average age of fleet (years)		
	1980[1]	1990	1980[1]	1990	% change		1980[1]	1990	% change	1980[1]	1990	% change
Pre-World War 1												
New York City (NYCTA)	230	246	5,587,635	6,645,594	19	10	6,303	5,255	-17	19.9	18.1	-9
Chicago	88	96	1,128,595	1,019,255	-10	-1	1,100	924	-16	19.1	13.6	-29
Boston	38	38	329,772	546,477	66	10	385	320	-17	18.9	14.6	-23
Philadelphia (SEPTA)	38	38	468,053	407,457	-13	13	430	271	-37	31.9	23.3	-27
New York City (PATH)	14	14	227,800[2]	278,039	22	10	232	297	28	14.7	17.8	21
Post-World War 2 - large												
Washington	19	70	388,623	994,187	156	27	296	478	61	4.2	8.7	107
San Fransisco	71	71	624,749	891,229	43	19	439	388	-12	7.7	12.9	68
Atlanta	12	34	n/a	360,042		38	99	138	39	1.3	6.9	431
Post-World War 2 - small												
Philadelphia (PATCO)	16	16	102,495	100,117	-2	13	117	96	-18	8.7	17.4	100
Cleveland	19	19	73,710	57,513	-22	2	105	38	-64	22.6	7.0	-69
Miami		21		109,693		26		82			8.0	
Baltimore		13		65,684		14		60			5.4	

[1] Figure for fiscal year ending between 1 July 1980 and 30 June 1991.
[2] 1981 figure. 1980 figure unavailable.

SOURCE: *National Urban Mass Transportation Statistics 1981 Section 15 Annual Report* and *Data Tables for the 1990 Section 15 Report Year*. Washington, D.C.: Department of Transportation. *Employment and Earnings*. Washington, D.C.: Department of Labor.

TABLE 6: Wage data.

Date:	New York City average hourly earnings in manufacturing payrolls ($/hr.)	Top hourly earnings of New York City (NYCTA) maintenance and train operators ($/hr)	Top hourly earnings of New York City (NYCTA) cleaner ($/hr.)
April 1980	6.24	9.40	7.42
April 1981	6.79	10.15	8.01
April 1982	7.28	11.24	8.95
April 1983	7.84	11.92	9.49
April 1984	8.17	12.40	9.87
April 1985	8.59	13.41	10.67
April 1986	8.89	14.21	11.31
April 1987	9.33	15.06	11.99
April 1988	9.30	15.97	12.71
June 1989	9.71	16.77	13.35
May 1990	10.16	17.67	14.07
% Change April 1980-May 1990	63	88	90

Source: *Employment and Earnings,* Washington, D.C.: U.S. Bureau of Labor Statistics. *New York City Transit Authority documentation.*

TABLE 7: 1980-90 employment changes.

Subway	Operating Employees			Employees in transportation and maintenance			Employees in general administration[2]		
	1980[1]	1990	% Change	1980[1]	1990	% Change	1980[1]	1990	% Change
Pre-World War 1									
New York City (NYCTA)	30,290	27,441	-9	26,236	19,106	-27	4,054	8,335	106
Chicago	4,150	4,294	3	3,822	3,143	-18	328	1,151	251
Boston	2,881	2,707	-6	2,702	1,971	-27	179	736	311
Philadelphia (SEPTA)	1,855	1,908	3	1,649	1,688	2	206	220	7
New York City (PATH)	1,100	1,312	19	954	1,124	18	146	188	29
Post-World War 2 - large									
Washington	2,399	3,478	45	1,994	2,822	42	404	656	62
San Fransisco	1,702	2,098	23	1,473	1,554	5	229	544	138
Atlanta	458	1,235	170	312	752	141	146	483	231
Post-World War 2 - small									
Philadelphia (PATCO)	329	329	0	273	243	-11	55	87	58
Cleveland	416	362	-13	301	289	-4	115	73	-36
Miami		452			373			79	
Baltimore		485			374			112	

[1] Figure for fiscal year ending between 1 July 1980 and 30 June 1981.
[2] Employees in general administration include station personnel (see Table 2 definitions).

SOURCE: *National Urban Mass Transportation Statistics 1981 Section 15 Annual Report* and *Data Tables for the 1990 Section 15 Report Year.* Washington, D.C.: Department of Transportation. *PATH numbers by telephone interview.*

TABLE 8: 1992 marketing information.

Subway	Hours of weekday service	Price varies by distance ?	Price varies by time of day ?
Pre-World War 1			
New York City (NYCTA)	0^{00} - 24^{00}	no	no
Chicago	0^{00} - 24^{00} [1]	no	no
Boston	5^{15} - 0^{50}	no[2]	no
Philadelphia (SEPTA)	5^{00} - 24^{00}	no	no
New York City (PATH)	0^{00} - 24^{00}	no	no
Post-World War 2 - large			
Washington	5^{30} - 24^{00}	yes	yes
San Fransisco	4^{00} - 1^{30}	yes	no
Atlanta	5^{00} - 1^{00}	no	no
Post-World War 2 - small			
Philadelphia (PATCO)	0^{00} - 24^{00}	yes	no
Cleveland	3^{30} - 22^{30}	no	no
Miami	5^{25} - 24^{00}	no	no
Baltimore	5^{00} - 24^{00}	yes	no

[1] 4 lines operate 0^{00} - 24^{00}. 1 line operates 4^{00} - 2^{00}. 1 line operates 5^{00} - 22^{00}.
[2] Double fare paid for travel to and from 3 outlying stations.

SOURCE: *Telephone interviews.*

TABLE 9: capital expenditures.

Investment category	New York City (NYCTA) subway capital expenditures (millions of 1990 $s).[1]			
	1982-1986	1987-1991	1992-1996	1997-2001
Track	1,929	2,628	2,318	3,163
New cars and car overhaul	3,588	1,620	79	1,497
Stations	345	713	1,164	806
Shops and yards	714	357	331	1,077
Security	37	21	540	0
Miscellaneous	555	588	806	1,099
Total	7,168	5,927	5,238	7,642

[1] 1982-1991 numbers refer to actual expenditures, 1992-1996 numbers refer to the proposal pending before the New York state legislature, and 1997-2001 numbers are estimates.

NOTE: New route expenditures are excluded.

SOURCE: *New York City Transit Authority documentation.*

TABLE 10: asset lives.

Investment Category	Useful life (years)
Subway track	40
Surface and elevated track	20
New cars	35
Car overhaul	10
Station modernization	35
Overhaul shop rehab	30
Police district offices	15
Substation power equipment	40

SOURCE: *New York City Transit Authority documentation.*

TABLE 11: 1990 bus costs and taxi pricing.

Bus company costs per passenger ride		*Taxi Pricing Schedule*	
Operator	Cost[1] per passenger mile ($)	Category	Charge ($)
Command Bus Company	.65	For each .2 mile	.25
Green Bus Line	.86	Fixed fee	1.25
Jamaica Buses	1.19	For each 75 seconds of waiting time	.25
Queens Surface Corporation	.74	Night surcharge for use between 8 p.m. and 6 a.m.	.5
Triboro Coach Company	.64		

[1] Calculated by dividing total costs of company (including depreciation and interest expense) by total passenger miles provided.

SOURCE: *1991 Transit Operating and Financial Statistics.* Washington, D.C.: American Public Transit Association. *New York City Taxi and Limousine Commission documentation.*

LIST OF FIGURES

Figure 1: New York City (NYCTA) subway map.

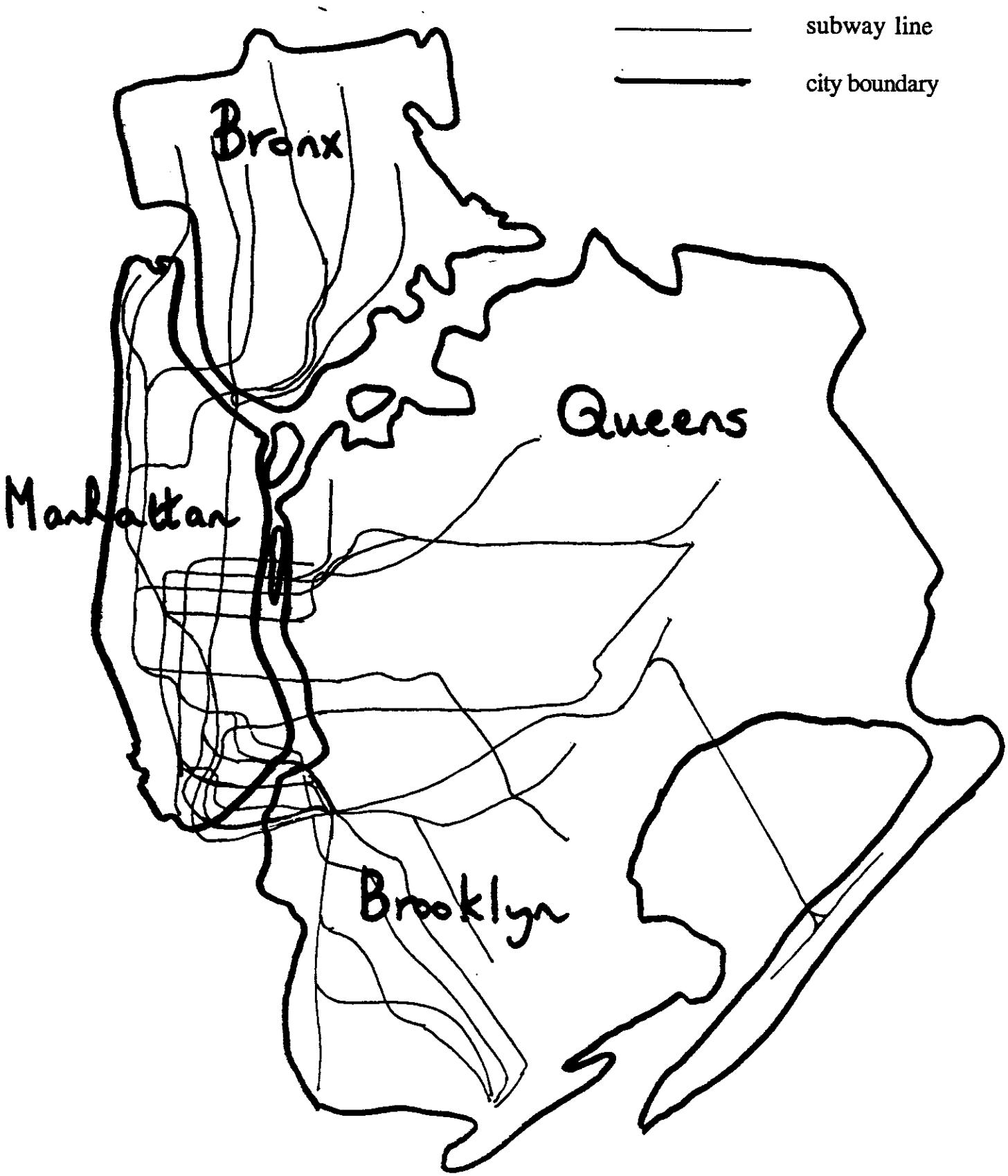
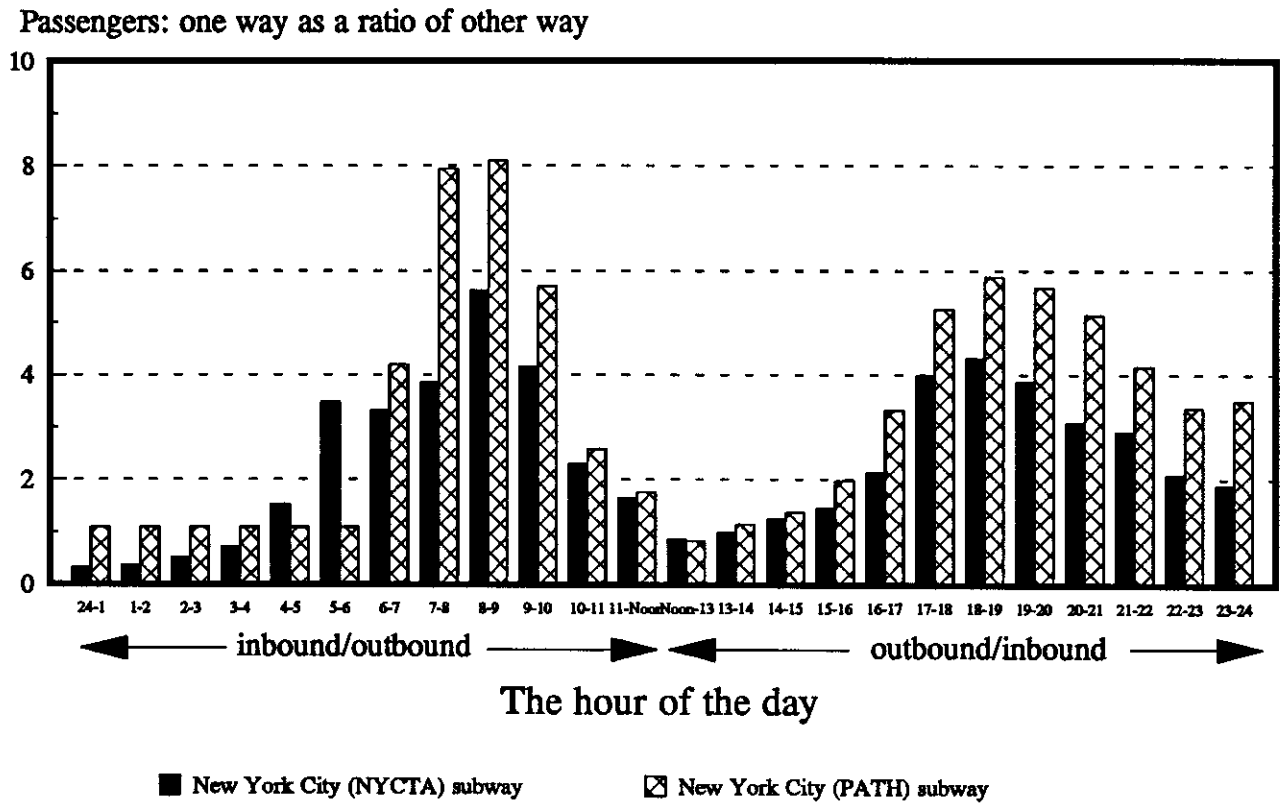


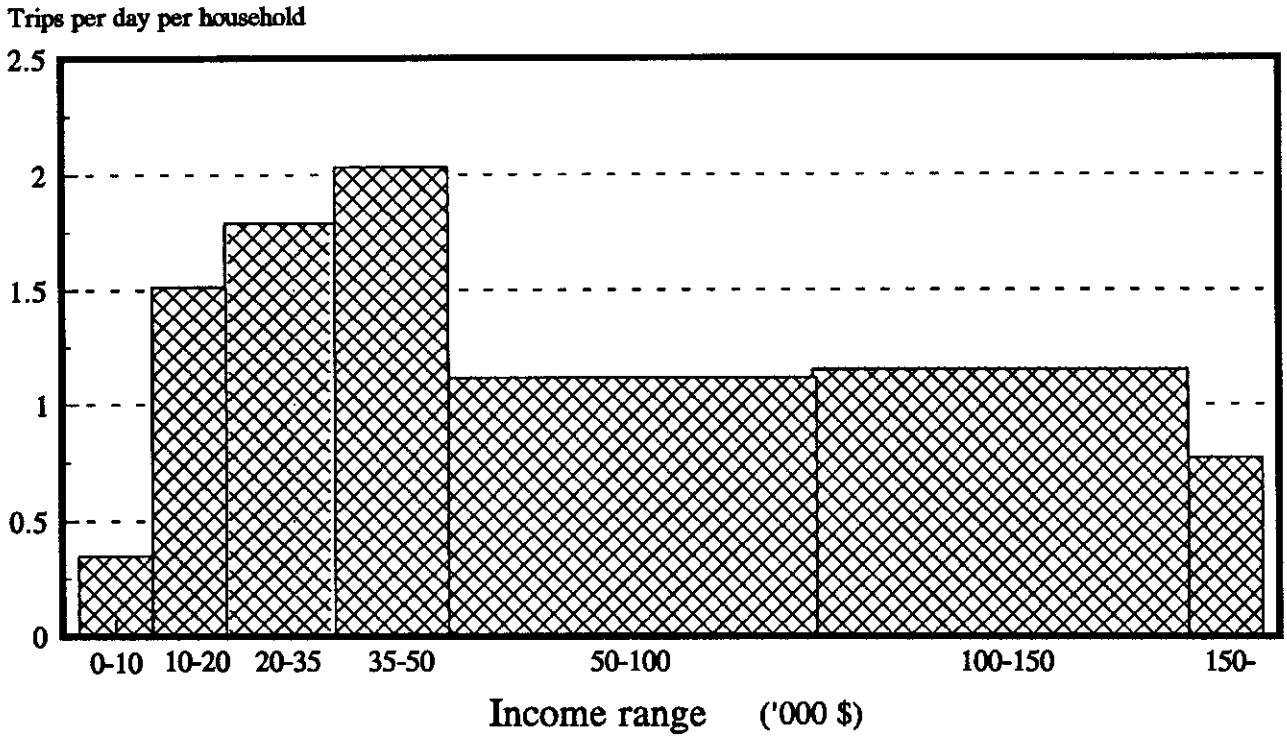
Figure 2: 1990 New York City (NYCTA and PATH) subway ridership flows.



EXPLANATION: The height of each bar in the left-hand side of the histogram measures the number of inbound passengers per outbound passenger by hour (on the horizontal axis). The height of each bar in the right-hand side measures the number of outbound passengers per inbound passenger by hour.

SOURCE: Using numbers from Appendix A.

Figure 3: 1989 New York City (NYCTA) subway ridership by household income



SOURCE: Using numbers from Appendix B.