Amtrak's Productivity in the Northeast Corridor: Past and Future

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Productivity analysis, the relationship between outputs and inputs in any given process, is used to evaluate the performance of the main passenger rail services in the Northeast Corridor (NEC) during FY 2002-2012 and to make inferences about high-speed rail (HSR) for the next 30 years.

A non-parametric single factor productivity (SFP) Törnqvist trans-log index sets ridership, revenue, revenue passenger-miles (RPM) and available seat-miles (ASM) as outputs, and operating costs as inputs. According to the analysis, the NEC experienced considerable yet highly volatile productivity growth during FY 2002-2012 (in the range of 1-3% per year). Amtrak, the National Railroad Passenger Corporation, increased its ability to fill up trains and economically exploit the available capacity, but did not perform equally well on the supply side. Service changes, technical problems with train sets, targeted capital investments, and economic recession and recovery were the main drivers of productivity change. Amtrak's two primary services, the Acela Express and Northeast Regional were very sensitive to external events, had large economies of scale, and implemented slow adjustment of capacity via rolling stock and infrastructure improvements, which varied depending on the service.

Inferences about future productivity were based on Amtrak projections for the post-2012 period. The geographic and socioeconomic characteristics of the NEC reveal a potential for a successful introduction of HSR. But while Amtrak's vision for HSR in the NEC is realistic in terms of productivity gains, it is risky and possibly inadequately ambitious in terms of speed of implementation. Revising the current projections to make them more aggressive, incorporating additional planning approaches, accelerating key stages of Amtrak's vision, and coordinating with the FAA in the planning process may improve the implementation of HSR in the NEC.

The NEC from 2000 to 2012

The Northeast Corridor (NEC), stretching from Washington, D.C., to Boston, MA, is the most densely settled region and one of the economic engines of the country. The NEC is a complex multi-state, multi-operator, multi-use, and multi-owner railway corridor. It runs through several major metropolitan areas, 12 states and the District of Columbia, and involves eight commuter operators and one intercity travel operator (Amtrak).

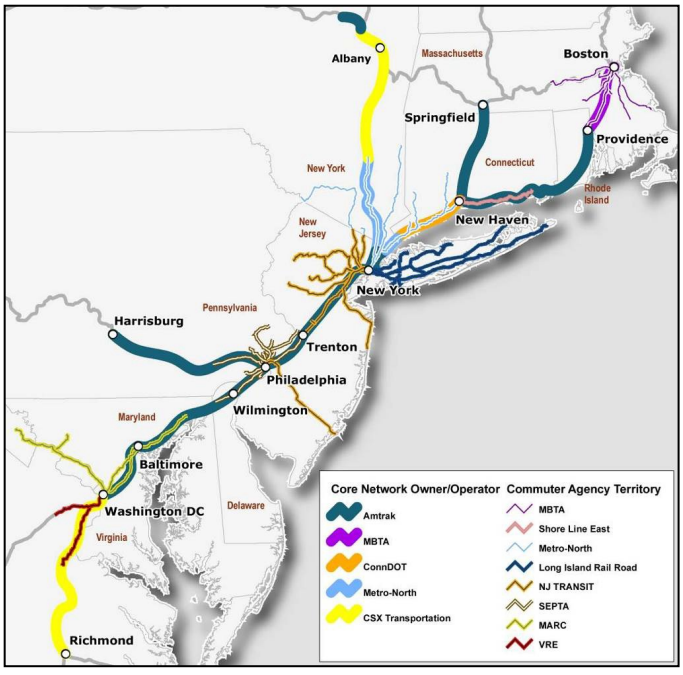

Figure 1. NEC Ownership and Operations [1]

Besides the NEC as a whole, two Amtrak services are the subject of study: the Acela Express and the

Northeast Regional (NR). Average operating speeds are 70-80 mph for the Acela and 60-65 mph for the NR, and total travel time is 6 ½ and 8 hours, respectively, from Boston to Washington.

The period from 2000 to 2012 was characterized by regional congestion, increased rail transportation demand, route changes in 2005-06, technical problems with Acela trains in 2002 and 2005, economic recession in 2008-09, and allocation of federal funding for capital investments since 2009. In this period, the capacity-constrained NEC gained significant air/rail market share and operational surplus, with a particularly profitable Acela and increasingly utilized NR, but maintenance backlogs and infrastructure constraints remained.

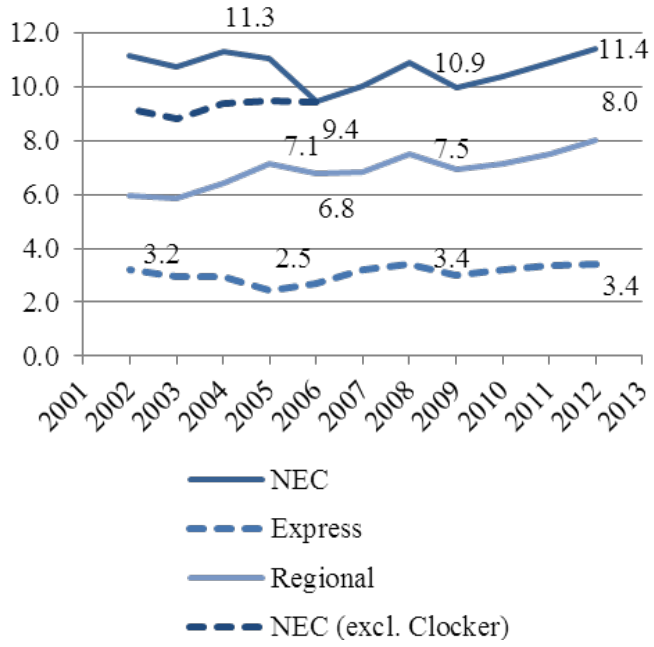

Figure 2. NEC Ridership (million passengers) [2]

Productivity Methodology

Productivity is, at the most fundamental level, a relationship between outputs and inputs used to evaluate the performance of an entity such as a country, industry, firm, system or process. Its popularity among researchers is due to the possibility of explaining the long-term growth of an entity, as well as the sources of growth. Of interest are the factors behind such a change in productivity, the drivers of productivity, which can be classified as technological change, organizational change, and externalities.

This research uses Single-Factor Productivity (SFP), which simplifies the analysis to a single-output single-input process.

Output and input data were reported by Amtrak. The available outputs were ridership, (ticket) revenue, revenue passenger-miles (RPM), and available seat-miles (ASM). The available inputs were operating costs. Monetary quantities were inflated by the corresponding CPI to 2012 dollars.

As there is only a single input but four distinct outputs, four SFP metrics were used to strengthen and validate the analysis, each providing different insights: On the supply side, ASM SFP with respect to operating costs is a proxy for the effectiveness at generating transportation capacity; on the demand side, ridership, revenue, and RPM SFP with respect to operating costs are measures of the effectiveness at exploiting the available capacity. Revenue SFP with respect to operating costs, in particular, reflects how effective Amtrak was at economically exploiting the available capacity.

Each year-to-year SFP metric was calculated via a non-parametric Törnqvist trans-log index, and then compounded to obtain the cumulative SFP, with 2005 as the base year for all calculations. Finally, a sensitivity analysis with respect to the route definitions and the inflation parameters showed that results were robust to changes in key assumptions.

NEC Productivity 2002-2012

As shown in Figure 3, from FY 2002-2012, the NEC experienced highly volatile but overall considerable SFP growth (in the range of 1-3% per year), which was boosted by the notable SFP improvements of the past three years.

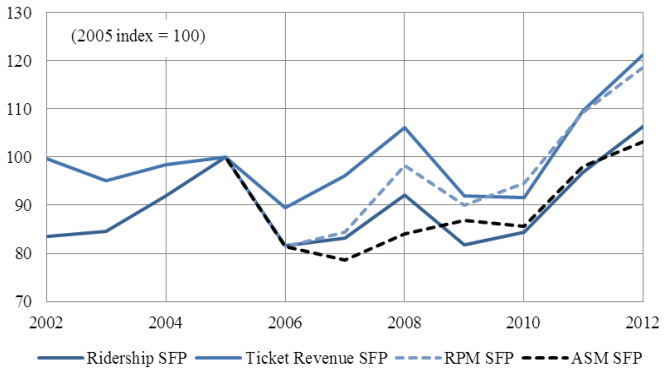

Figure 3. NEC Cumulative SFP Growth FY 2002-2012 [2]

The differences in demand-side (RPM SFP) and supply-side (ASM SFP) productivity metrics show that Amtrak increased its ability to fill up and economically exploit the available capacity, but did not perform equally well on the supply side. Service changes, technical problems with trains, targeted capital investments, and economic recession and recovery were the main drivers of productivity change. For example, the technical problems of 2005-06 and the economic recession of 2008 resulted in yearly productivity dips as low as -19%, while the recent surge in ridership and allocation of funding produced increments as high as 20%.

Acela and NR services were very sensitive to external events, had large economies of scale, and implemented slow adjustment of capacity, but their performance was not uniform. Acela was more sensitive than NR to changing conditions.

As far as productivity concerns go, the ability to implement and operate HSR in the NEC was more tied to the state of the regional economy, and less to managerial and operational practices.

Inferred NEC Productivity 2012-2040

For studying future productivity, a scenario of analysis for 2012-2040 was based on Amtrak's Vision for HSR in the NEC [3]. This is a proposed $150-billion stair-step phasing investment strategy with two sequenced programs: the NEC Upgrade Program (NEC-UP), which would reach top speeds of 160 mph, and the NEC Next Generation HSR (NextGen HSR), which would reach top speeds of 220 mph and reduced travel time to 3 hours from Boston to Washington.

The six stages of the program are:

(1) 40% additional capacity of the Acela Express achieved through additional passenger cars by 2015.

(2) Doubling of the HSR frequencies from New York to Washington by 2020.

(3 - 4) Improved and expanded service on the entire alignment, thanks to the Gateway program, track improvements, and additional HSR trains by 2025.

(5) Completion of the New York-Washington NextGen HSR segment by 2030.

(6) Full establishment of the Boston-Washington NextGen HSR service by 2040.

In this scenario, the available (projected) outputs are ridership and revenue, while the inputs are operating costs.

By 2040, the NEC could become 20–40% more productive (on the demand side) with respect to 2013. The expected yearly average growth in ridership (0.7%) and revenue SFP (1.3%) would be within the ranges of what the NEC achieved in the past (~0.5%–3.0%), though perhaps on the low side. Productivity increments would be highly variable and most likely occur in later stages. Peak changes, however, are within the ranges of productivity gains or losses that the NEC showed in the past: +/- 13–18% on peak years.

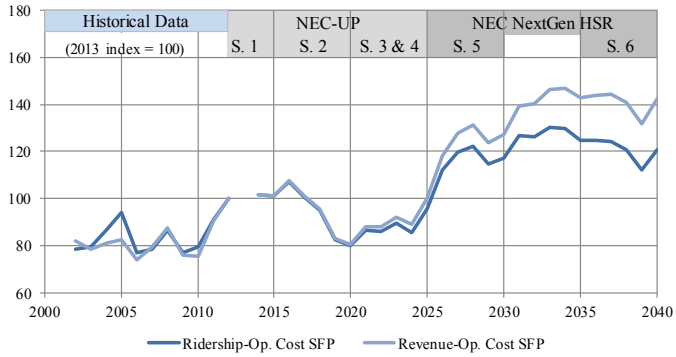

Figure 4. NEC Cumulative SFP Growth 2002-12, 2013-40 [2]

However, there are some risks. Since productivity benefits may take years to realize, and if financial leverage and political support are lacking during adverse times, or if the market and managers are slow in adapting to changing conditions, the successful implementation of HSR is uncertain.

Moreover, the NEC VISION lacks ambition in some ways, since projected cumulative productivity growth is low in comparison to the growth of the past decade (20-40% in the next 30 years vs. 20% in the past 10). Also, the plan to improve management is not explicitly mentioned, but improved management within Amtrak and coordination with other major travel modes may reveal a greater potential for productivity improvements.

Thus, we offer the following recommendations to decision-makers: revise projections of ridership and revenue; involve the FAA in the planning process and consider air/rail cooperation explicitly; consider the possibility of improved management practices within Amtrak and other stakeholders of the NEC; prioritize

stages of the implementation that promise the highest productivity improvements, e.g., the Gateway Program; and use scenario planning and design flexibility in the investment alternatives.

References

[1] The NEC Master Plan Working Group (MPWG) (2010). The Northeast Corridor Infrastructure Master Plan.

[2] Archila, A. F. (2013). Intercity Passenger Rail Productivity in the Northeast Corridor: Implications for the Future of High-Speed Rail (S.M. in Transportation, MIT)

[3] Amtrak (2012). The Amtrak Vision for the Northeast Corridor: 2012 Update Report.

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