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Characteristics of Austrian passenger transport policy development since the 1950s

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Abstract: This paper investigates the transport policy development and characteristics of the Austrian passenger transport sector from the 1950s onwards. The analysed performance indicators deal with the three most prevalent modes of transport (cars, trains and airplanes) and are linked to independent decision-making units (passengers) and their motives (price, quality and time to destination) as well as to goals and decisions involved in government policies. In this theoretical framework, we identified three developmental phases, using an interdisciplinary approach to assess the development of three variables of interest (number of car, air and train passengers). In the long term, transport policy aimed to solve the rigidity and lack of vision in train transport and the extensive use of cars. Air transport was a steadily growing segment in a close and positive relationship with trains, which is in line with the transport political orientation towards Vienna Airport and train connections to the capital city. The post-war phase (1945–1970) was characterised by enormous growth in the number of cars, an upswing in air transport and stagnant train transport. The second phase (1970–1994) was defined by a progressive liberalisation of rail transport and a plan to balance the growth rates of car, train and airplane performance variables. Finally, in the 1995–2019 phase, the growth in train transport increased; however, this growth remained far below the growth rates of air and car performance variables. Transport policy achievements and shortcomings for future research are suggested.

Keywords: Austria; passenger transport sector; transport policy; train liberalisation; road; train; air

JEL Classification: N74, R42, R48, R40

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Introduction

National and international transport policies provide a framework for the allocation of scarce resources for different modes of passenger and freight transport in national economies. In particular, infrastructure master plans can influence the behaviour of agents in the market in the long run, which makes the means of transport mutually dependent (Fichert, 2017). The goal of this paper is to analyse the long-term and short-term dependencies in passenger transport and assess the differences between transport policy development phases in the Austrian economy since the 1950s.

Austria is a unique case from a historical point of view because of its position between two political blocks after WWII. Owing to the *Staatsvertrag* (State Treaty) with the Allies, the country had to keep apart from the mainstream Western European economic and political integration and also from the economic cooperation of the Eastern Bloc. However, the post-WWII economic struggles and war-damaged Austrian economy developed swiftly, and its good results were reflected in the transportation sector (for example, in increased individual mobility), as was seen during similar phases in the developed countries of Western Europe.

In this article, we focused on the development of transportation policy in Austria between 1950 and 2019, divided into three subperiods, partly based on important economic integration milestones.

1) The first phase, between the 1950s and 1970s, was, according to Emberger (2017), defined by post-war rebuilding and construction of all transportation modes (primarily roads). This phase was characterised by a rapid growth of all transport performance indicators (passengers and number of cars).

2) The second phase, between 1970 and 1994, was defined by the impacts of the first and second Oil Crises, with a tendency towards a multi-modal view and an integration of environmental issues. Emberger concludes that 'these two phases were dominated by the concept of demand-oriented infrastructure provision' (p. 14). This phase starts a year after the Austrian Federal Railways were transformed into an independent company. This phase could be shorter, given the fact that European Union politics began influencing Austria's transport policy before the country joined the EU (as suggested by Emberger, 2017).

3) The third phase includes the time since 1990, which Emberger characterised as a departure from the initial environmental concerns and an increased focus on the economic viewpoint of Austrian transport policy, with the key phrase 'Strengthening of Austria as a business location'. The last phase is the longest and includes the economic crisis of 2008/2009 and stops just before the pandemic of 2019/2020 (followed by an economic downturn). However, new passenger transport challenges were introduced in the 1996 White Paper: A Strategy for Revitalizing the Community's Railways (Commission of the European Communities, 1996). This paper stated that market forces should also be introduced into domestic passenger transport ('*A new kind of railway is needed. It should be first and foremost a business*', Commission of the European Communities, 1996, p. 3) and that EU member states should ensure that their rails can contribute fully to a European

intermodal transport system. From this year on, policies were aimed at further development of multi-modal transport.

This classification barely allows for consistent time-series estimation. We assume that only the 2008 crisis that caused discontinuities in the transport performance series will affect our estimations because transport is directly dependent on aggregate economic performance. There is also a need for national transport policy development research called for by the Special Interest Group on National and Regional Transport Planning and Policy at the World Conference on Transport Research Society in 2014 (Emberger, Shibayama and Wang, 2021). Additionally, we define the fourth phase starting with the COVID-19 pandemic in 2020. However, owing to the lack of data and its timeliness, we will not be discussing it.

The demand for transport is naturally connected to economic growth and tourism-related economic activities. Economic policymakers use many types of information sources to adjust their national and regional transport policies. For example, past economic policies used census data for commuting, national and international tourism and various transport performance figures about passengers and goods. These data enter into transport models (so-called Verkehrsmodell Österreich), and transport policymakers can estimate the future development and infrastructure policy requirements (Grebe et al., 2020). This planning is based on a system view and complexity; however, it has its limitations. The experience with long-term modelling in the United Kingdom showed that simple trend models have comparable value added with those from more complex and expensive national transport models. No model can substitute for strategic thinking, and the decisions are based on a sheer range of possible technological pathways (Blainey, Preston, 2019).

Therefore, we will visualise the transport performance and development data and describe them using simple statistical indicators like means, growth indexes and the Spearman rank-order correlation coefficient. To assess the long-term dependencies and development of the dataset, we need to analyse the growth variables using time-series visualisation and statistical models.

Material and methods

Time series about rail transport performance and the number of cars before 1995 come from archival documents (Table 1). The train data are available in ‘Amtliche Eisenbahnstatistik der Republik Österreich für das Jahr 19xx – Band I’ issued by the Federal Ministry of Transport (Bundesministerium für Verkehr). The methodology of counting the performance in ‘passenger-kilometres’ changed in 2006 to the international standard; however, there is a long-term consistency in sampling and estimating techniques, and the break in series does not cause unexpected data variability. The personal car data comes from ‘Österreichische Verkehrsstatistik 19xx’ issued by Statistik Austria. The time series is also without significant breaks or spikes, and the methodology of counting (registered cars) is consistent. We cross-checked the time series in other sources as well. The comparison revealed no significant variation: Statistisches Handbuch für die Republik Österreich (Österreichisches Statistisches Zentralamt, 1950–1991); Die österreichische Verkehrswirtschaft in Zahlen. Informationen der Bundessparte Transport und Verkehr der Wirtschaftskammer Österreich (Wirtschaftskammer Österreich, 2011–

2020); Zahlen Daten Fakten (Österreichische Bundesbahnen, 2007–2021); Statistik Straße und Verkehr (Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie, 2000–2018); EU Transport in figures. Statistical pocketbook (European Union, 2011–2018); Panorama of transport. Statistical overview of transport in the European Union. Data 1970–2001 (European Union, 2013).

The air transport performance indicator comes from the World Bank database and covers the air traffic carried on scheduled services. However, European air transport regulations have made it more difficult to classify air traffic as scheduled or non-scheduled. This time series is reported by the International Civil Aviation Organization and represents the international and domestic scheduled traffic carried by the air carriers registered in a country. Datasets about bus transport were considered as well; however, they are not available in the long term. The dataset is published in Mendeley data (Vokoun, 2021).

Passengers are, to some extent, independent decision-making units, and their motives are centred around the type of travel, total price, time to the final destination and desired quality of the chosen transport. The longer the national and international journeys, the more intermodal nature is observed (Hietzschold, 2008), along with certain price cross-elasticities that consider issues like the risk of traffic congestion and vehicle's pollution negative impact on the environment (Litman, 2004).

Table 1. Variable overview

Variable	Observations	Mean	Std. Dev.	Min	Max
Number of cars (stock)	51	3,361,771	1,152,419	1,196,584	5,091,827
Number of train passengers	50	209,000,000	40,400,000	170,000,000	317,000,000
Number of air passengers 'carried'	49	5,638,432	5,000,662	511,400	16,200,000
Number of train passenger-kilometres in thousands	49	8,832,415	1,859,169	6,437,528	13,200,000

For each phase (1950–1970, 1970–1994 and 1995–2019) we applied our interdisciplinary methodological approach based on economic history, statistics and econometric analysis:

1) Economic history: We focused on the literature review of historical events, economic policies and technological development to capture the historical context and address important factors of transport performance development (Vokoun, Stellner, 2015).

2) Statistics: We utilised various descriptive statistical tools like time-series graphs and average values of transport performance variables. We applied the Spearman rank-order correlation coefficient to all pairs of time series of transport performance to assess the strength of the mutual relationship and address possible trends. Data for the first period (1950–1970) were available only partially, so the descriptive analysis

is only partial. To assess the rapidity of growth of the time series, the compound annual growth rate (CAGR) was calculated (ending value divided by the beginning value, this fraction to the power of 1/n, this value minus 1).

3) Econometric analysis: We considered two steps. Firstly, we wanted to produce Prais–Winsten's (PW) estimation of train performance as the dependent variable in each period and the full sample as well. Data for the first period (1950–1970) were available only partially, so the econometric analysis is only partial and covers the period 1970–2018. The PW process allows for error terms to be serially correlated over time and requires time-series stationarity, and we needed to test for a unit root in all variables (White, 1980).

We assumed before the estimation that the time series would be non-stationary. So, in the case of time-series non-stationarity, variables are transformed from levels to annual growths (X_t–X_{t-1}), which produces a stationary output. This analysis provides a ground for the interpretation of annual growth dependencies. In the case of managed, and to some extent simpler, transport systems, growth in one transport mode performance indicator is followed by a proportional growth of subsequent transport mode indicators—for example, growth in train performance is followed by a growth in the number of cars and air passengers carried.

Transport policy and transport system development

A transport system deals with the movement of persons or goods and reflects the demand for travel and goods transportation within a given area and the supply of transportation services to satisfy this demand. Both the demand and supply are influenced by technological, political and economic developments. The most visible policies are public infrastructure investments and other fiscal expenditures set by the government. This paper analyses the midterm and long-term development of the Austrian national transport system. Our analysis is divided into three phases (I. 1950–1970 post-war phase, II. 1970–1994 EU integration phase, III. 1995–2019 EU phase).

I. 1950–1970 post-war phase

During the first phase, the transportation sector was in critical condition, owing to the impacts of World War II and the post-WWII division of the country into occupation zones governed by the Allies. Reconstruction was needed as quickly as possible, and it was crucial to update the rolling stock and the national railway system, Austrian Federal Railways (Österreichische Bundesbahnen, ÖBB). In the railway sector, the electrification of the main network routes was on the agenda. Emphasis was placed on road construction (mostly motorways, bypasses and other main road sections), primarily to decrease unemployment and support tourism.

Financing improvements in infrastructure (such as the renewed building of motorways, electrification of the railway or expansion of the telegraph and telephone networks) was simplified by the income from fuel taxes paid by car drivers, but also thanks to the incredible economic growth (so-called Wirtschaftswunder). Finance Minister R. Kamitz and Federal Chancellor J. Raab were responsible for this economic growth as they had developed a new form of a social market economy (Pellar, Brandstetter, 2014). Höbelt

(2020) defined the post-1953 Austrian purchase of German cars en masse as one of the indicators of economic prosperity. More than 50,000 imported cars were licensed in 1959, more than 100,000 in 1965 and more than 200,000 in 1972.

Until the 1970s, transport policies in Austria were understood and conducted as part of the national economic policy (Kvizda, et al., 2018). The main objectives were to ensure effective transportation production. Ecological aspects of pollution or energy and landscape consumption were not considered initially, owing to economic priorities. Steininger (2009) states: 'The free choice of means of transportation from the microeconomic perspective received more attention than general objectives such as environmental protection, resource-efficiency, optimisation of energy use, or road safety. Therefore, the formative resources of transport policies remained unused, which would influence not only the transport sector but also the entire economic and social systems' (p. 31).

In the 1960s, the massive worldwide growth of individual road transport reached Austria, which negatively impacted the segment of rail transport, causing it to go into recession. The situation was primarily caused by quickly developing individual car road transport that more easily adapted to users' demand for quality and speed (Roth, Divall, 2015). Another reason for the recession of rail transport is the fact that Austrian railways were under state management—in essence, a monopoly of the ÖBB. The government acceded to the liberalisation of railway transport in 1968 and worked out the Austrian Transport Master Plan 1968 (Bundesministerium für Verkehr und verstaatlichte Unternehmungen, 1968; Emberger, 2017). The ideas presented in the concept were, however, applied to the actions of the actors participating in transport only partially (Genser, 1987; Staudacher, 2003; Lindenbaum, 2003).

Table 2. Development of the transport performance indicators between 1950 and 1970

Year	Number of passenger cars	Number of train passengers	Number of air passengers carried	Number of train passenger-kilometres in thousands
1950	51,314	135,101,576	100,000[E]	4,292,619
1955	143,099	158,548,407[E]	150,470	5,574,772
1960	404,042	177,421,722	466,812	6,839,497
1970	1,196,584	170,164,353	511,400	6,437,528
Year	Number of passenger cars per capita	Number of train passengers per capita	Number of air passengers carried per capita	Number of train passenger-kilometres per capita
1950	0.01	19.48	0.01E	618.85
1955	0.02	22.83E	0.02	802.56
1960	0.06	25.18	0.07	970.62
1970	0.16	22.79	0.07	862.33

Note: [E] – own estimation based on simple linear prediction and Österreichisches Statistisches Zentralamt (1950) data

The development in this phase can be described using a standard CAGR. In the case of cars, the annual growth was 17.05%. Train passengers were growing by only 1.16%, given the fact that there was quite developed infrastructure long before 1950. Another indicator that captures growth in train transport are train passenger kilometres in thousands, and the growth rate there was 2.05%. Air transport developed rapidly as well, and the annual growth rate was approximately 8.5%. There is still a high variation between 1960 and 1970; however, we can observe that the potential in train transport was to some extent reached sooner in the 1960s (Table 2).

II. 1970–1994 integration phase

The second phase (1970–1994) of the development of Austrian transport policy was defined by the progressive liberalisation of rail transport, a transformation of the ÖBB into an independent economic company and the electrification of the majority of railways. Railways were built and upgraded in the 1970s under the 'Debt' chancellor Bruno Kreisky and his infrastructural policy of deficit spending (Brugger, Kleinert, 2019) in a welfare state era. The state-wide electrification was finalised in 1976. Simultaneously, road construction was a priority, especially motorways. However, the international Oil Crisis of 1973/74 caused a recession and thereby influenced the change from 'Austrokeynesianism' to 'Debt-Keynesianism' to secure full employment, meaning a departure from a strict budget policy. However, the policy of deficit spending that was originally planned as a temporary crisis-cushioning mechanism became more problematic with the Second Oil Crisis in 1979/80 (Pellar, Brandstetter, 2014). Around this time, the Austrian government realised that the infinite growth of road transport is not possible solely with fossil fuels (Emberger, 2017).

Owing to the increase in individual road transport, the recession in railway transport continued during the 1970s and 1980s. A profound change in views on issues and problems of transport policy came during the late 1980s. Its economic aspect was expanded by the ecological aspect of energy scarcity and finite resources. For the first time, the economically consequential costs of transport were taken into consideration. Regarding the development of transport policy, Steininger (2009) concludes that 'Furthermore, over the years, transport policy achieved more proximity to the citizens by including regional and local policies in transport policy decision-making processes. Thus, a holistic transport policy emerged by integrating economic, environmental, technological and social components. Unfortunately, frequent discrepancies between the interests of the affected regions and the actions of decision-makers in Vienna harbour a great potential for conflict, which has not been alleviated by membership in the European Union' (p. 31). For example, the aim was to improve the short-distance public transport system to enable rural travellers to commute to workplaces in urban agglomerations without having to use their own cars. Genser (1987) stated, regarding the new concept that: 'The demand to have a dynamic conception causes the start of continuous planning processes by this project, with utilising feedback to a great extent. For this purpose, instruments will be installed, like date base for traffic structures, decision support system, etc., and suitable organisations are provided' (p. 53).

Since the fall of the Iron Curtain in 1989, Austria has enjoyed disproportionate benefits from liberalised trade and capital flows, certainly also owing to Austria's geographical location and the resulting close relationship with Central and Eastern European countries (Steininger, 2009). Transit traffic and other international (that is, non-Austrian carriers in Austria) traffic, in particular, experienced a sharp increase as a result of the far-reaching changes in Central and Eastern Europe.

The massive increase in road freight traffic through Austria became a serious problem in terms of congestion and environmental problems (noise and air pollution). At the end of the 1980s, the government stated that the aim of Austrian transport policy should be shifting the current transport demand to the mode of transport with the best characteristics in terms of transport safety, economic benefits, environmental benefits and efficiency. In addition, a road safety campaign was launched to reduce the number of road fatalities. Further restrictions on road transport to shift freight traffic to rail included the introduction of restrictive speed limits for noisy heavy-goods vehicles, the introduction of a ban on night driving on certain routes and an increase in the capacity of piggyback transport in Austria (Emberger, 2017).

In the early 1990s, owing to the country's planned entry into the European Union, its transport policy changed and major investments in railway projects were approved (ÖBB-Personenverkehr AG, 2009; Kvizda et. al., 2018). Specifically, in 1991, the government approved the Austrian Transport Masterplan 1991. Its main priorities were as follows: 1. Avoidance of unnecessary traffic; 2. Promotion of environmentally friendly means of transport and redistribution towards non-motorised means of transport; 3. Use of newest technological standards; 4. Public participation; 5. Introduction of true cost pricing in the transport sector; 6. Cooperation between different means of transport (Emberger, 2017). It defined the key issues as transit traffic, combined transport, transport in metropolitan areas, transport in rural areas, open borders in Eastern Europe, regional railroads and the financing of local public transport (Parlament Republik Österreich, 1991).

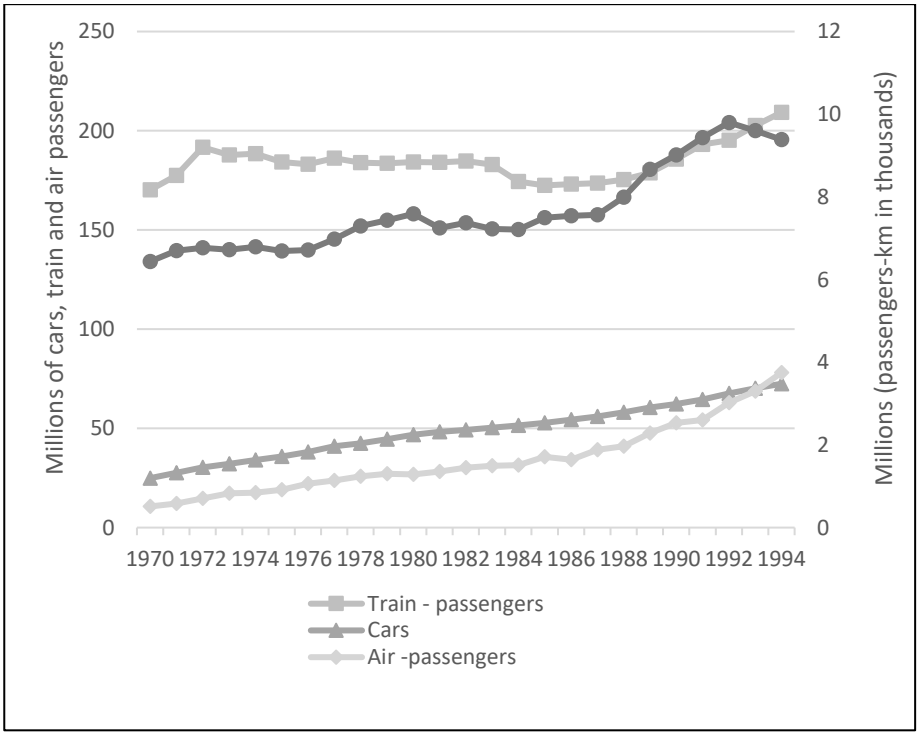
The transformation of the rail transport market advanced in 1992 when the Federal Government passed a law under which ÖBB became a legal entity that was no longer financed by the state budget but remained completely state-owned. This relieved the state budget of a large financial burden and allowed the state to invest in extensive modernisation of the transport infrastructure and fleet renewal (Seidenglanz, Nigrin and Dujka, 2015).

The average annual growth of the total number of cars was 4.55% or, in absolute terms, roughly 95,000 cars a year. The highest standard deviation and average annual growth (8.65%) were found in the number of air passengers (Table 3). The slowest annual growth was in the number of train passengers (0.87%) and passenger kilometres in thousands (1.58%).

Table 3. Summary of the transport performance indicators between 1970–1994

Variable	Number of observations	Mean	Standard deviation	Min	Max
Train (passengers-km in thousands)	25	7,666,118	1,029,396.00	6,437,528	9,799,021
Air (passengers carried)	25	1,636,308	857,442.20	511,400	3,747,900
Train (passengers)	25	184,000,000	9,306,197.00	170,000,000	209,000,000
Cars (total number)	25	2,334,063	649,079.50	1,196,584	3,479,595

Figure 1. Summary of the transport performance indicators between 1970 and 1994



The annual growth rates correspond with the time-series development (Figure 1). The number of train passengers crossed the 200 million passenger threshold in 1993, and we can observe a growth dampening after the year 1972 and a growth recovery of both train transport indicators around 1987–1989.

The highest rank correlation is between the total number of cars and air passengers (Table 4), which corresponds with the time-series development as well (Figure 1). Both time series are also correlated with the number of passengers-km in thousands. The number of train passengers does not correlate with any of the transport indicators. This indicates that there is no direct relationship between train transport and other indicators. The relationship is more complex and thus requires further econometric investigation.

Table 4. Pairwise Spearman's rank correlation coefficients, 1970–1994

Rank correlations	Cars (total number)	Train (passengers)	Air (passengers carried)	Train (passengers-km in thousands)
Cars (total number)	1			
Train (passengers)	0.2115	1		
Air (passengers carried)	0.9985*	0.2077	1	
Train-pkm (passengers-km in thousands)	0.9292*	0.3138	0.9254*	1

Prais–Winsten's AR(1) regression suggests that there is a relationship between the growth in the number of cars and train passengers (Table 5). The growth in air transport does not affect the growth of train transport performance. In the case of train performance in passenger kilometres, the results are statistically insignificant. The results suggest a modal dependence between the number of cars and train passengers because growth in one indicator is followed by the growth of the other. The average annual growth of cars in this period was roughly 4.55%. Based on the regression analysis results, this average growth of 95,000 cars per year was accompanied by an average growth of 1,235,970 passengers in train transport.

Table 5. Prais–Winsten regression 1970–1994

Δ Train passengers	Coef.	Robust Std. Err.	T	P > t	[95% Conf.	Interval]
Δ Cars	109.4	34.71	3.15	0.005	37.241	181.60
Δ Air	2.9	5.83	0.5	0.623	- 9.22	15.03
Constant	- 9157030	3217642	- 2.85	0.01	- 1.58E + 07	- 2465578

*Number of obs = 24, F (2,21) = 5.29**, Prob > F = 0.0138, R-squared = 0.4298*

III. 1995–2019 EU phase

In the third phase (1995–2019), through the integration of Austria into a supranational organisation—the EU—in 1995, the country relinquished parts of its sovereignty,

especially in economic policy matters, because transport policy from then on has been determined by the EU regulations (Lindenbaum, 2003; Seidenglanz, 2006; Kvizda et al., 2018). Since the 1990s, however, the chances for a holistic, citizen-oriented transport policy have worsened again, as economic problems and the associated shift from an open public spending policy to a restrictive budget policy, in congruence with the Maastricht criteria, repressed the transport policy and ecological goals for the time being. Steininger (2009) stated the following: 'Nevertheless, the greatest challenge for national transport policy will probably be, on the one hand, to manage pan-European traffic flows and make them bearable for the regions, and, on the other hand, to create or maintain regional and local mobility offers' (p. 31).

According to the White Paper issued by the EU in 1996, market liberalisation in rail transport was supposed to provide a solution to the following problems: 1) improving the financial situation and solvency of railway undertakings; 2) enabling railway undertakings to access the infrastructure and to separate the operation of railway infrastructure and the provision of transport services; 3) improving the quality of services provided in public transport; 4) continuing the reorganisation of railway infrastructure; 5) enabling railway transport to cross EU borders; and 6) providing retraining programmes for employees made redundant in the process of railway restructuring (Commission of the European Communities, 1996).

Under the influence of the EU, Austria has focused on trying to build, make functional or modernise major transport routes—so-called Pan-European transport corridors—part of which pass through Austria. They are also included in the EU Accession Agreement (in order, Dresden/Nuremberg, Prague, Vienna, Bratislava, Győr, Budapest, Arad, Bucharest, Constanța, Sofia, Thessaloniki and Istanbul) (Stancu, Varzaru and Lazarescu, 2014).

In 1998, the Austrian government passed the Federal Transport Infrastructure Plan 1998. Emberger (2017) evaluated it as such: 'Output of the project was a detailed list of infrastructure projects for rail and road with a total sum of 21.8 billion Euro for the rail and 2.9 billion Euro in the road sector. No monitorable targets regarding transport-related indicators were provided. The document provided a list of infrastructure projects which should be realised in the coming decades to meet the future demand' (p. 11). The document also highlighted the role of the EU in determining Austria's transport policy: The future network should be an integrated part of the European transport networks (TENs, TINA), but should at the same time actively influence their future development (Parlament Republik Österreich, 1998). The use of public-private partnership models and the generation of funding through motorway vignettes on motorways for passenger cars were envisaged to finance the planned infrastructure projects.

Despite the partial successes in transport policy, there were trends in Austria during the 1990s that did not go in the right direction from a EU perspective. These primarily included the non-opening of the transport market in rail transport; the uneven development of individual modes of transport; the failure to include all external costs in transport prices; the growth and amount of congestion on the main transport routes; and the growth of negative environmental and health impacts (Seidenglanz, 2006).

One of the major measures taken in 2000 was the centralisation of transport management under one ministry. Until then, owing to the fragmentation of competencies for the

development of different modes of transport into different state bodies, no truly comprehensive development plan had been drawn up that covered rail, road, air and water transport as a whole. Different analyses and forecasts had been produced for different modes of transport, but they had not been effectively linked. At the same time, an agreement was reached between the state and the federation on transport development and the transfer of competencies to the Federal Ministry of Mobility, Innovation and Technology (Republik Österreich, 2000).

In 2001, the European Commission modified the common transport policy by issuing the White Paper–European Transport Policy For 2010: Time to Decide, setting as objectives: 1) the achievement of sustainable development through a balanced development of individual modes of transport, 2) a decrease in transport-related exhalations, 3) an increase in air quality, 4) a reduction in the level of noise generated by transport and 5) a decrease in the dependence of transport on petroleum products (Commission of the European Communities, 2001).

Austria responded to the White Paper in 2002 by approving the Austrian Transport Master Plan. The main focus was on Sustainable Mobility: 1. Strengthening Austria as a business location; 2. Efficient and demand-oriented extension of transport networks; 3. Improvement of transport safety; 4. Secure financing of infrastructure projects; and 5. Making implantation easier and faster. In other words, they were promoting territorial integration, eliminating capacity bottlenecks, improving network effectiveness and taking cost-effectiveness into account. Emberger (2017) pointed out that the economic point of view in transport policy-making again became the dominating objective and that the paradigm of 'avoidance of unnecessary traffic' completely disappeared from the agenda in the period between 1998 and 2013. The total volume of investments was 45.1 billion Austrian schillings (Bundesministerium für Verkehr, Innovation und Technologie, 2002; Rosinak, Snizek, 2003; Whitelegg, 2005; Steininger, 2009).

At the beginning of the 21st century, the use of railways for freight transport continued to be promoted by the Austrian government and EU policies by favouring it over road transport. This was also in line with the general recognition that the use of rail transport was particularly suitable for the transport of full-load, especially bulk, goods over medium and long distances (Buehler, Pucher and Altshuler, 2017). After 2004, the situation changed. The context of transport policy changed with the accession of 10 new Central and Eastern European countries to the EU in 2004. Apart from the three Baltic republics, Cyprus and Malta, the others had all been part of the Austro-Hungarian monarchy before 1918 (Czech Republic, Hungary, Poland, Slovakia and Slovenia).

Road transport of goods has grown at the expense of rail, particularly for cross-border deliveries. The predominance of road transport is one of the most serious problems of European transport policy today. Roads remain the main carriers of goods transport. A significant shift of transport from road to rail is only profitable for long-distance transport. Road transport is relatively faster and more flexible than other transport options (Grebe et al., 2020). At the same time, ÖBB struggled with a lack of funding and demanded an increase in government spending (Gürtlich, 2007). Sub-aspects of transport policy have also been dealt with from the beginning by Smart City and its specific section Smart Mobility (Grassegger, 2007).

In passenger transport, a trend similar to that of air transport can be observed at the beginning of the 21st century. While the volume of passengers carried has been increasing with growing offers of cheap tickets to certain destinations, customers have been mainly interested in precisely these cheap tickets, which do not necessarily translate into an increase in income (Seidenglanz, 2006; Maertens, 2018).

The rail freight market was fully liberalised in the European Union in 2007; in practice, this liberalisation means that any licensed rail company with the necessary safety certification can provide EU-wide freight transport (Jordan, 2006; Mayerhofer, 2006; Ludvigsen, 2009). The next phase of the liberalisation of the railway market in Austria was the transformation of the Austrian Federal Railways (ÖBB) into a holding company in 2005 and the reorganisation of ÖBB in 2009. Through its subsidiaries, ÖBB Holding is the owner and operator of the railway network and the country's largest passenger and freight carrier. It also allocates transport routes to new railway companies through public tenders, the fairness of which is supervised by the state-owned company Schienen-Control. Transport contracting authorities in Austria are forced by law to issue tenders in which the carrier is selected on the basis of not only the lowest required subsidy but also the level of service offered (fleet, speed). The first major private company in the Austrian rail market is the WestBahn, which began operations on the busiest route from Vienna to Salzburg in 2011 (Catharin, 2007; Taczanowski, 2015; Seidenglanz, Nigrin and Dujka, 2015; Tomeš, Jandová, 2018).

European Communities (2006), in the midterm review of the European Commission's 2001 transport White Paper, evaluated European transport policy since 2001 in the medium term, noting that the most significant changes in the general context include (1) EU enlargement; (2) the abandonment of the intention to gradually break the link between transport growth and economic growth; (3) the growth of the global economy and competition; (4) the rise in oil prices; (5) the implementation of the Kyoto Protocol; (6) the emergence of global terrorism; and highlighted (7) energy efficiency as a key strategy for improving transport. It recommended a shift away from transporting goods and passengers by road to forms of transport that pollute less and are therefore the basis of any sustainable transport policy. It also noted that rail is, however, sometimes seen as an unattractive mode of transport.

This is particularly true in the newly acceded countries of Eastern Europe, where, owing to poor infrastructure, significant investments will be needed to expand and qualitatively improve the capacity of the rail network. Railways, therefore, need to increase speed and improve service levels in all parts of the European Union if passengers and goods are to move from road to rail. Furthermore, in the new Member States, restructuring of rail transport and a market adjustment is necessary, which will require several socially difficult decisions and will lead to a significant reduction in employment in the rail sector (European Communities, 2006; Jarzembowski, 2007; Kvizda et al., 2018).

In the second decade of the 21st century, the European Union and its transport policy continued to restructure the European rail transport market and strengthen the position of rail in relation to other transport sectors. In 2011, the European Commission outlined a basic strategic vision for transport policy (European Commission, 2011). In the spirit of this, the Austrian government submitted the Austrian Transport Master Plan 2013, which formulated the Austrian transport policy until 2025. It sets out its main objectives: 1) to

make transport affordable, demand-oriented and barrier-free; 2) to halve the number of traffic fatalities by 2020 and reduce the number of accidents involving personal injury by 20%; 3) to reduce CO^2 emissions by 19%, particulate matter (PM2.5) emissions by approximately 50% and NOx emissions by up to 70% by 2025 compared to 2010; and 4) to optimise the system and organise traffic more efficiently (Federal Ministry of Transport, Innovation and Technology, 2012; Danielis, Scorrano and Giansoldati, 2021). The general orientation of the Austrian transport policy during the third phase did not change; still, the stimulation of the Austrian economic growth through improvements in transport infrastructure is the main focus. Emberger (2017) reviewed the development of the Austrian transport policy as follows: 'The Austrian transport strategy evolved over the last 40 years from a sectorial, demand-fulfilment-driven transport strategy towards an integrated multi-modal, demand-management-driven transport strategy, including some environmental issues. Further, an outlook is provided in which direction the national transport planning strategies should be developed to be able to tackle future challenges such economic, social and ecologic sustainability' (p. 1).

Table 6. Summary of the transport performance indicators between 1995 and 2019

Variable	Number of observations	Mean	Standard deviation	Min	Max
Train-pkm (passengers-km)	24	10,000,000	1,757,609.0	7,971,000	13,200,000
Air (passengers carried)	24	9,807,311	3,984,419.0	4,265,400	16,200,000
Train (passengers)	25	234,000,000	44,100,000.0	180,000,000	317,000,000
Cars (total number)	26	4,349,952	424,193.9	3,593,588	5,091,827

The standard deviation is lower, and the annual growth rates for cars slowed down substantially from 4.55% to 1.42% in the 1995–2019 period (Table 6). Air transport continued to grow rapidly, however, with a lower standard deviation and pace of 4.94% in comparison to the previous period (8.65%). The annual growth rate of the total number of train passengers doubled from 0.87 in the previous period to 1.67% in the 1995–2019 period. A slight decrease was also seen in the growth of passenger kilometres (from 1.58% to 1.38%).

The economic crisis of 2008 hit air transport hard; however, the growth in passenger air transport recovered quite quickly, in 2010 (Figure 2). Such an extreme break in the time series can cause trouble in estimation and make the air transport equation problematic in this rather short period. The time series of the number of cars is rather flat in comparison to the train transport indicators.

All the variables are rank correlated, and the coefficients of direct relationships are also statistically significant at 5% (Table 7). The highest value of the rank correlation coefficient between train passengers and passenger kilometres suggests that the train network's capacity was evenly utilised, which we did not observe in the previous period.

Train transport now directly correlates with all the variables, and it seems that the passenger transport system is more interconnected than it was before.

Figure 2. Summary of the transport performance indicators between 1995 and 2019

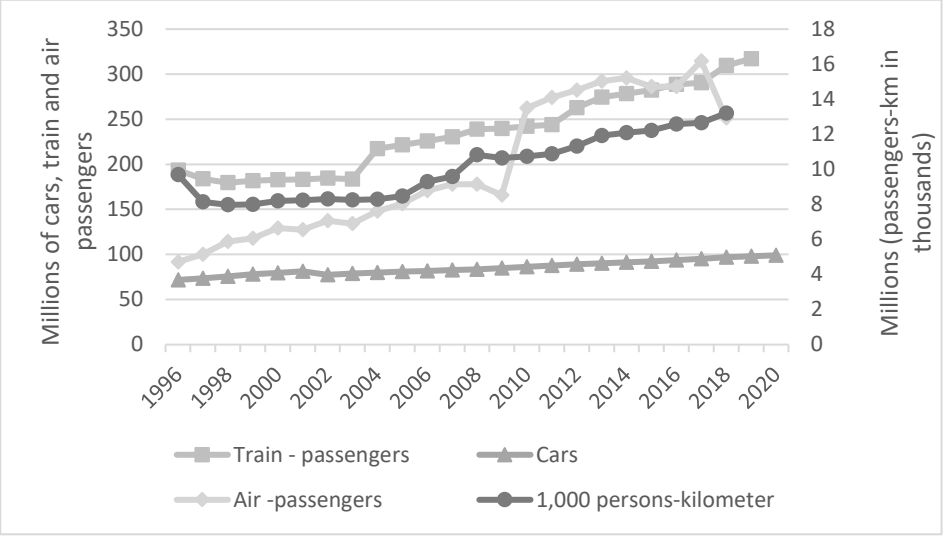


Table 7. Pairwise Spearman's rank correlation coefficients, 1995–2019

	Cars (total number)	Train (passengers)	Air (passengers carried)	Train (passengers-km in thousands)
Cars (total number)	1			
Train (passengers)	0.9162*	1		
Air (passengers carried)	0.9357*	0.8861*	1	
Train-pkm (passengers-km in thousands)	0.8487*	0.9678*	0.8209*	1

Prais–Winsten's AR(1) regression suggests that there is no relationship between the growth in the number of cars and train passengers. The growth in air transport has also no effect on the growth of train transport performance. In the case of train performance in passenger kilometres, the results are statistically insignificant (Table 8).

Table 8. Results of the Prais–Winsten's regression, 1995–2019

Δ Train passengers	Coef.	Robust Std. Err.	t	P > t	[95% Conf.	Interval]
Δ Cars	- 13.2	21.31	- 0.62	0.542	- 57.52	31.10
Δ Air	- 1.23	1.24	- 0.99	0.332	- 3.82	1.35
Constant	5561297	2649646	2.10	0.048	51057.47	1.11e+07

*Note: Number of observations = 24, F (2,21) = 5.29**, Prob > F = 0.0138, R-squared = 0.4298*

A long-term data analysis 1970–2019

The last econometric analysis encompasses the last two periods (1970–2019). Prais–Winsten's AR(1) regression suggests that there is no relationship between the growth of the number of cars and train or air passengers. This is expected because the growth rates of transport indicators in the two analysed periods differed substantially. The relationship seems more complex, and we cannot say that they are in a simple direct relationship.

A recent development, the new post-pandemic phase

After 2020, the Austrian government is focusing on decarbonisation by promoting electric and alternatively powered vehicles. As part of the government's 2030 climate strategy and emission reductions, a new call was launched to promote electromobility. Subsidies have been announced for expanding charging station infrastructure, as well as supporting the development of alternative drives and fuels. The aim is to reduce emissions in transport by 30% by 2030 and then electrify it as much as possible. In 2020, the railway development plan for the next 6 years was published. It has four main pillars: strengthening S-Bahn capacity in and around major cities, modernising regional railways and electrifying them, and increasing freight capacity and digitisation (security and traffic management systems).

Regarding the development of railways, the ÖBB framework plan 2021–2026 was adopted by the Council of Ministers in 2020. Over the next 6 years, 17.5 billion euros will be invested in a modern rail network. The planned expansion of services and the introduction of the 1-2-3 climate ticket will make an important contribution to achieving climate neutrality (Bundesministerin für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie, 2020).

The European Commission has set a target of achieving climate neutrality in Europe by 2050. To support the achievement of this target in transport, which accounts for a quarter of the EU's total greenhouse gas emissions, the Commission has declared 2021 as the European Year of Rail. A significant modal shift will be needed from less environmentally friendly modes of transport, such as roads in particular, but also aviation, towards the greenest modes, namely, rail and inland waterways, without compromising the connectivity of goods and people that is at the heart of the single market. This, in turn, will require measures to improve governance and to increase the capacity of railways and inland waterways, which the Commission has committed to propose by 2021. COVID-19 has hit the transport sector particularly hard. There is a broad consensus that European

and national regulations should take advantage of the opportunities offered by the recovery plans to end the crisis to promote a dual green and digital transformation.

Discussion and Conclusions

We analysed the development in Austrian passenger transport using historical and statistical time-series analysis. Therefore, there is naturally certain path dependence in train transport. The development was to some extent predestined by the infrastructural and technological pace of renewal and the orientation towards passenger needs. The issue was the optimal management of extensive infrastructure and labour force.

The first phase was subject to the availability of goods and capital. Given the rate of growth, car and aircraft were the winners of rising passenger transport. In the second phase, we can say the transport policy reflected the balance between the three modes of transport. Again, the most popular fast-growing modes of transport were cars and aircraft. Trains dealt with large fluctuations in the first phase and were a good complement to air transport in the second phase. Again, in the third phase, cars and aircraft passengers were growing faster than trains. Train transport is at crossroads because the time to destination, quality of services and price are less attractive than in car and aircraft transport sectors. Recently, the transport policy has not reflected a balance between the three modes of transport. However, we can see a certain uplift and the need to address the issues in train transport. High-speed train projects seem to be the reason as they put train transport back in demand, and we observed a long-term relationship between the number of cars and train passengers. This issue of extensive car transport was managed by economic policies.

Lessons from the first phase (1950–1970)

The first period is characterised by an enormous growth of the number of cars, an upswing in air transport and, in comparison, rather stagnant and fluctuating train transport. The transport economic policy was primarily aimed at building new roads and highway infrastructure because of the high demand for cars. We agree that cars were a better and faster way of transport than using trains (Steininger, 2009; Emberger, 2017). They were managed by the large ÖBB organisation and the quality of infrastructure, together with the wagon train park was poor and in need of renewal. A logical step was the improvement of the outdated infrastructure and partial liberalisation of train transport in 1968. In this post-war period, it was all about reaching the potential of all modes of transport, given the high demand of passengers. Transport policy was all about availability and as fast growth as possible.

Lessons from the second phase (1970–1994)

The second phase was influenced by the Oil crises and the disagreement of Austrian regions regarding transport policies (Steininger 2009) at the beginning of the phase. At the end of the phase, the opening of the borders of Czechoslovakia and Hungary escalated the environmental issue of an ongoing strong growth in the number of cars and transit truck transport. This phase has the slowest growth of train transport and the government decided to further, but again only partially, liberate this rather slow-developing and stagnant segment, in comparison to road and air transport. There were good efforts to create a vision in the Austrian train sector; however, every decision-maker faced a

problem because the organisation managing train transport was an incumbent with an extensive labour force.

However, it seems that trains were a good complement to cars. There is a relationship between the two modes of transport. That led to the support of transport policies aimed at the avoidance of unnecessary traffic and the promotion of environmentally friendly means of transport at the end of the period in the 90s. The environmental efforts were however not quite successful in this period and road transport, in terms of the number of cars, was steadily growing, more than five times faster than the number of train passengers.

Lessons from the third phase (1995–2019)

In the last period, billions of euros were spent on road and train infrastructure; however, the uneven growth of train, road and air transport continued as suggested by Seidenglanz (2006). Our results suggest no relationship at all between all the three modes of transport. There was a general uplift in train transport after two periods of rather slow growth. The growth rate of train passengers doubled from 0.87% in the previous period to 1.67%; however, we could still observe a slight decrease in the growth rate of the passenger-kilometres indicators (from 1.58% to 1.38%). The goal of the transport policy was to invert the short-term relationship between cars and trains; however, it was rather not successful.

The positive development trend in road infrastructure was catching up with the latest technologies and meeting the high demand for road transport (Grebe et al., 2020). Train transport lagged because of the issue of non-use and non-utilisation of full capacity respectively, in comparison to roads and aircraft. A long-term issue is the continuing liberalisation of the train market, and the low demand for train transport even with incentives. The uneven development could be caused by slow technological and quality development in the sector. Regarding technologies, there are very few medium-high (160–250 km per hour) and lack of high-speed (250 and more km per hour) trains at the beginning of the phase in comparison to Germany or France. High-speed trains cannot go faster than 250 km per hour in Austria, and there is only approximately 70 km of high-speed infrastructure at the end of the phase. The growth of negative effects on the environment and health continued. Environmental issues were significant and contributed to more disagreement between Austrian regions and the lack of a complex plan that would encompass the development of the air, road and train transport sectors (Republik Österreich, 2000).

Long run view (1970–2019)

Our summary analysis of the entire period of 1970–2019 suggests that no relationship exists between the three modes of transport and economic policies aimed at passenger transport. The modes of transport were not consistent and interdependent. This means that all the means of transport diverged from each other rather than reaching some mutual modal equilibrium. However, further analysis based on the vector error correction model can reveal if there is a mutual modal split equilibrium (Minárik, Vokoun and Stellner, 2018). The reasons for the different pace of development were cars and the boom in air transport in recent years. Future research should also aim at modal split equilibrium models, the relationship of each transport performance indicator with macroeconomic

aggregates like production, and particularly transport policy expenditures. Additionally, researchers face the problem of calculating positive train sector externalities, which are important for policymakers' decisions.

We can say that transport policy was aimed at solving the rigidity and lack of vision in train transport and the extensive use of cars. Air transport was a steadily growing segment with a close and positive relationship with trains, which conforms to the transport policy regarding Vienna Airport and train connections to the capital city. Eventually, a statistically significant mutual relationship was observed between the number of cars and train passenger transport. This result confirms the high demand for car journeys and the economic policy preference for road transport infrastructure projects.

Billions of euros are again waiting to be spent on transport infrastructure projects. It is unclear if we can expect high demand for environmentally friendly cars and aircraft or a preference for trains. Economic decision-makers were prioritising high-demand projects, such as air and road travel. The vision for trains seems to be high-speed trains; however, the lower-speed infrastructure is vast, and roads and airports are the winners in Austria. In all periods examined, train transport was an issue and the waves of liberalisation were full of expectations. Upgrading train infrastructure or building new high-speed infrastructure is quite risky because those projects are extremely resource-intensive, environmentally questionable and long-term.

Similar development with a lack of vision for train transport exists in countries like Czechia and Slovakia. Trains do not always reach longer destinations faster than buses or cars (Skupinová et al. 2021), and they are popular as suburban connections. Liberalisation of the railway industry also causes many expectations; however, issues remain, because private operators have been unprofitable and accused of predatory pricing (Tomeš, Kvizda, Nigrin and Seidenglanz, 2014; Tomeš, Jandová, 2018). Those countries that joined the EU later than Austria are somewhere between the second and third phases. They are heavily oriented toward road infrastructure, and the liberalisation of trains does not solve all of the issues in train transport. Cars dominate the modes of transportation, and there is a lack of analyses of the future of train transport. Creating a reasonable and viable vision for this stagnant sector is problematic. The state is still in control of train infrastructure, and governments will decide how billions of euros will be spent on train infrastructure. Austria can be an example for neighbouring countries and promote a vision based on its experience dealing with train transport issues. One way or another, decision-makers in Austria and other Central European economies should address the problems and provide good arguments in terms of price, quality and time to the destination because green technologies in the dominant car and air sectors are developing fast.

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