

Accessibility by air passenger transport related to Switzerland

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Abstract

The paper discusses the evolution of accessibility by air passenger transport and as related to Switzerland since World War II. Background for the work is the research Action COST-340, supported by the European Union (EU).

The paper discusses the evolution of accessibility by air passenger transport related to a small country highly dependent on exports and services, given:

- the location (topographical at the heart of the major cultural and economic area of Europe)
- the evolution of the world-wide background, best represented by the consequences of World War II, ICAO, IATA, air transport technology improvements, globalisation of standards, commerce and of the specific ways of life, and, last but not least, by deregulation/liberalisation in air transport)
- the evolution of the home-made context in order to keep in touch with the evolution world-wide (air transport infrastructure development) and taking into account the consequences of political, strategic and financial mishaps (EU-integration, airline alliances and collapses)
- the impact of collateral events

In this regard the relevant features related to accessibility have been tracked as follows:

- air passenger transport network development, as "regulated" and as "liberalised"
- development of flight departure opportunities and of the number of seat supplied
- development in the reduction of (air) travel time
- development of air travel fares
- case study results

Keywords

Accessibility – air transport – Switzerland – case study – COST – 2nd Swiss Transport Research Conference – STRC 2002 – Monte Verità

1. Context

The paper deals with the evolution of air transport in general and the accessibility by air passenger transport in particular as well as related to Switzerland since World War II.

1.1 The evolution of air transport in general

The evolution in air transport in general are highlighted by the following milestones and their consequences:

- Thanks to air pioneers, seaplanes (air and water as "infrastructures" are given by the nature), airmail transport (commercial management training), profitability, technical improvement and (tragic) experiences (World War II).
- Mastering flying led to an impressive development in transport from continent to continent (passenger transport by sea collapsed and never recovered as ocean liners), as well as within Europe (wealthy rail passengers being attracted), first between economic and financial centres.

1.1.1 The technical and entrepreneurial milestones

As a short chronology of the events at large and the adventures in particular

Hot-air balloons just before the French Revolution

1783: First start of a hot-air balloon (Montgolfière) with a human being on board (*Pilâtre de Rozier and the Marquis d'Arlandes*)

1785: Crossing of the Channel (*with Blanchard and Jeffries*)

Airships and aeroplanes quite at the start of the 20.th century

1900-.... : the airship eposée (with Graf Zeppelin) including journeys round the world, to the Northpole (Amundsen and Nobile), and passenger transport from Europe to Rio de Janeiro and to New-York lasting up to the eve of World War II.

1903: On board "a machine heavier than the air" ... (*Brothers Wright*)

1909: First flight crossing the Channel (*Blériot*)

1913: Over the Mediterranean from Saint-Raphaël to Bizerte (*Roland Garros*)

1925-....: More or less regular flights for mail transport between Toulouse-Casablanca-Dakar (*Jean Mermoz; Antoine de Saint-Exupéry* as a pilot and well-known writer)

Promoting discovery and mail transport flights (on seaplanes)

1927-....: As an air transport company for mail (*Aéropostale*)

1926: From London to Cape-town via Cairo (in 94 days) to test landing places for a future air service (*Alan Cobham*)

1927: Swiss pioneer Walter Mittelholzer is using with a seaplane water surfaces (rivers, streams and lakes) in Africa to reach Beira (Mozambique) and Cape-Town along the ocean coast (in 77 days). In order to finance the expedition, the flight has a geological, geographic and photographic background.

1927: First crossing of the Atlantic Ocean non-stop from New-York to Paris (5800 km) in 33 hours-and-a-half (*Charles Lindbergh* as a pilot and "postman" in St.-Louis)

1930: First crossing of the South Atlantic Ocean non-stop (*Jean Mermoz*); first commercial flight Europe- South-America (*Aéropostale*) and first regular flight over the Andes to Santiago de Chile.

¹ A new start is being tried ("Airship") for expected use as coast guard (in Great-Britain and the USA instead of helicopters) and ("Cargolifter") for heavy goods transport and/or inaccessible location

- 1931: Ad Astra and Balair merge into Swissair (*Walter Mittelholzer*).
- 1933: Aéropostale mutates to Air France.
- 1934: First crossing over the Pacific with stop-overs in Honolulu, Midway, Wake, Guam on to Manila (*Pan American Airways*).

After World War II

- 1947: ICAO is starting to be the framework for civil aviation operations worldwide according to the Chicago Convention
- 1952: First commercial passenger "Jet" in service ("Comet")
- 1954: First scheduled Swissair-flight to South America (64 seats at half the current speed) via 3 stop over abroad on to Rio de Janeiro and Sao-Paulo.
- 1956: Introduction of the "Metropolitan" (44 seats) on Swissair's European services
- 1957: First scheduled Swissair-flights to the Far East via 5 stop over on to Tokyo.
- 1960: First Swissair "Jets" on short- ("Caravelle") and long-haul ("DC-8") flights
- 1971: First wide-body "Jumbo-Jet" in service (350 seats at current speed)
- 1975: Swiss-based regional airline (Crossair) founded (as Business Flyers, until 1978)
- 1976: First SST, Super-Sonic Transport, in service (100 seats at double sonic speed)
- 2002: Introduction of the A-340/500, the civil aircraft with the longest range (300 seats on 16'000 km non-stop)
-: First "Sonic-Cruiser" (300 seats at just under sonic speed)
- 2006: First "Super-Jumbo" (555 seats upward at current speed)

1.1.2 Accessibility by air passenger transport

The accessibility of (world- wide) destinations by air passenger transport is not only the result of pioneer spirit, entrepreneurial skills and technical feasibility, but has to be managed for international operations. Air transport and maintenance, flight procedures, air traffic control, safety and security issues have to reach a level of standardisation that make them effective and efficient.

in general

the evolution of the world-wide background

is best represented by the consequences of World War II, as it was then very much expected that the technology improvements in aircraft design and logistic skills will provoke a formidable boost in civil air transport. Plenty of experienced airmen and aircraft were then available and ready to work for the airline industry. Moreover, compared to the devastated ground transport infrastructure within Europe, infrastructure for air transport could be operational again at a relatively very short term. A repetition of the easiness of air transport to recover quickly to modern standard levels was observed again after the collapse of the communist countries in Eastern Europe. The best way to go there was and is still by air.

Just before the end of World War II, the USA and many other countries met themselves as they understood that it was urgent to set a background of reference for civil aviation operations. The Chicago Convention still runs as the point of reference for the past and foreseeable future of international civil aviation development in each relevant matter. Rights and duties of 187 signatory states are settled in 96 articles, which are requisite conditions for a safe and reliable civil aviation and are of prime importance for accessibility in air transport. Both following principles are of relevance for the air transport system needs:

- The guaranty of unlimited and exclusive air space sovereignty within the state borders (Art.1)
- The commitment for a state to implement international standards and guidelines for the air traffic regulation as well as recommendations for the installation of navigation aids.

Apart of general and liable principles, the organisations issued from this Convention are the keys for a working civil air transport:

- ICAO, International Civil Aviation Organisation, since 1947 permanent running, is the administrative body in charge of setting, reviewing and controlling the implementation of standards, guidelines and recommendations in design, operations and safety issues with regard to airports, air routes and navigation aids.
- IATA, International Air Transport Organisation, the administrative body for the international airlines in charge of dealing with tariff structures in the past (before deregulation and liberalisation processes developed in the airline industry), now in particular as a ticket clearing office among the airlines. It co-ordinates twice a year landing and departure slots at airports according to the wishes of the airlines. It is the international airline forum and its chairman is a spokesman of the airline industry as a whole.

The Annex to the Chicago Convention stipulates 5 freedoms in air transport; there are furthermore 3 (new: 4) freedoms² considered as non-official.

² - as "no-commercial" freedoms:

1st freedom: the right to overfly the airspace of a contractual state without landing

2nd freedom: the right of "no-commercial" landing in a contractual state

- as "bilateral" freedoms:

3rd freedom: the right to pick-up air passengers, freight and mail in the home state and to drop them off in the other contractual state

4th freedom: the right to pick-up air passengers, freight and mail in the other contractual state and to drop them off in the home state

- "multilateral" freedoms:

5th freedom: the right to carry air passengers, freight and mail between the other contractual state and a third-state, given that the flight has to begin or to end in the home state

6th freedom: the right to pick up air passengers, freight and mail in the other contractual state and, after a stop-over in the home state, to drop them in a third-state and vice-versa

7th freedom: the right to carry air passengers, freight and mail between the other contractual state and a third-state, without this air transport being part of an air link with the home state

8th freedom: The so-called cabotage-right. It is the right to carry air passengers, freight and mail within the other contractual state, by doing which new is as:

8th freedom: the flight has to begin or to end in the home state

9th freedom: the flight is a dedicated domestic flight.

The "Bermuda-Agreement" in 1946, beyond the establishment of freedoms in air transport, aims at sharing transport capacities and flight frequencies. This agreement never worked world wide. Instead, the principle of fifty-fifty sharing has long been preferred for political reasons. In the close past, variations such as 40%/60% have been embraced from case to case.

International agreements on the introduction of air links are commonly settled on a bilateral basis. One interesting aspect is that (up-to-now) it did not correspond to international usage to withdraw granted commercial rights, even if operations ceased for a while³. However if the designated company changes, the rights may not be transferred automatically⁴.

The deregulation/ liberalisation in air transport: Deregulation in civil air transport was introduced in the USA in 1978 by the President Carter administration, according to the "Deregulation Act" that was aimed at boosting airline competition on air services, in particular in air link supplies, flight frequencies and fare structures.

The deregulation process has come in the meantime under a merciless struggle. Almost all the US-airlines, which were set up since then, went into bankruptcy or had to merge⁵.

The step-by-step liberalisation of air transport within the European Union⁶ aims at minding the excesses of US-deregulation and at ensuring customer protection. Since the 1st of April 1997, the liberalisation of air transport within the EU has been fulfilled as EU-airlines may take profit from the 8 freedoms in air transport, the choice of flight frequencies, transport vol-

NB: the right relates basically to the (designated) airline of the home state.

³ this was the case after UNO-embargoes (for instance with Libya)

⁴ this was the case with the former Balair and is now the case with the defunct Swissair (for instance with Libya, as it was told)

⁵ the 6 largest US-airlines service about 80% of the airpassenger transport demand within the USA and the 3 largest among them (United, American and Delta) about two-thirds.

⁶ A harmonisation of air transport within the EU countries is also a main task (such as regarding regulations and air traffic control)

umes and fares, on each air link within the European Union. The task of the EU administration is to keep competition working.

the impact of collateral events

like the spectacular attack on the World Trade Center twin-towers in New-York (on September 11th, 2001). It is to fear that it could not be the last action of this kind and noone is going to speculate on the lasting psychological effects on the air passenger community.

In this context and as a matter of fact, it is worth mentioning that up-to-now the air transport industry has recovered from any crisis and made up the trend development of the former years.

and as related to Switzerland since World War II

Accessibility is related to a small country highly dependent on (high-yield) tourism and the export of services and manufactured goods.

the location

In this regard the location at the heart of Western Europe as a major cultural and economic area is a chance. Europe is at a one-and-a-half to two hours short-haul flight reach.

The topographical situation may improve the accessibility by air transport over ground transport access.

the evolution of the home-made context

Representatives of the Swiss economy, as well as Swiss politicians, were constantly aware of the prime importance for Switzerland to keep in touch with the evolution worldwide and have

backed air transport infrastructure developments⁷. The Swiss population was rather slow in being convinced, as results of past votations underline, but a majority finally accepted to adapt as the gap was obvious.

The Swiss cantons are responsible for keeping their airports running. The protection of national interests is the domain of the federal administration⁸ according to the Swiss Law on Civil Aviation (Schweizerisches Luftfahrtgesetz).

International agreements on the introduction of air links involving Switzerland are commonly settled on a bilateral basis and ratified by the Swiss Parliament, in most of the cases even unanimously. This highlights the prime importance of accessibility by air transport for the country⁹.

The unfavourable situation for Switzerland regarding air transport development with the countries of the European Union after the decision taken to not participate to the EEA, European Economic Area¹⁰, has been partly relieved by a bilateral agreement between the EU and Switzerland. It allows the participation to the liberalised air transport market within the European Union, with some restrictions:

⁷ for instance, as soon as in 1946, the international airport of Basle-Mulhouse (on French territory) was put into operation as binational and has developed since then into becoming trinational. It has become the home base of the largest European regional airline (Crossair), operating a very successful intra-European hub-and-spoke system ("Eurocross") which has tremendously boosted the accessibility by air of the Regio Basiliensis.

⁸ the administrative body being the Swiss Federal Office for Civil Aviation

⁹ Some agreements after ratification both sides are still on hold, as long as the context has to become more favourable for (commercial) success. This was the case with Australia, a country with no direct air links. Only thanks to having negotiated and ratified air transport agreements on time, air links with Switzerland could develop at a short notice.

¹⁰ decision taken by referendum on December 6th, 1992, by the Swiss cantons and the Swiss population

The Swiss airlines are granted the 3rd and 4th freedoms immediately without restrictions, and the 5th and 7th freedoms after a time gap;¹¹ however not the 8th freedom (cabotage within a single EU state).¹²

However and very unfortunately, a string of mishaps occurred in the nineties. Switzerland having put itself by referendum aside of EU-integration and -liberalisation of its air transport system, a merger (the "Alcazar"-Project with KLM, SAS, Austrian Airline) avorted, as well as a failed own alliance strategy headed by Swissair (the Qualiflyer Group), up to the final financial collapse of the SAirGroup.

the impact of collateral events

such as, without any real "force majeure", the "unthinkable" non-avoidance of the Swissair fleet grounding (on the 2nd-3rd of October 2001), which had psychological disastrous effects on the reputation of the country as a whole. The airline Swissair as such is ceasing operations as of April 1st, 2002. The potential consequences on accessibility by air are expected in traffic rights not being transferred automatically to a new designated company name.

¹¹ in principle 2 years after the agreement coming into force, that is having been ratified by all the parliaments (Switzerland EU, and of each EU-country. In case of a notice to quit one agreement out of 7 dossiers with the EU, the so-called "Guillotine"-clause will terminate all the seven agreements.

¹² the way of taking an equity majority into an EU-airline is allowed, providing this airline is not operating an air link with a destination outside the EU.

2. Accessibility as related to relevant features

The notion of accessibility by air is related to the context as already mentioned. Main related features have been tracked, such as the network development of air services, up to the operation of a hub-and-spoke system. Flight departure opportunities are to be included, as well as the number of seats supplied according to market request and comfort (ability for air passengers on business to change reservation at a short notice). The reduction in (air) travel time (considering also "door-to-door", thanks to better airport ground access) and in fares applied (particularly for leisure travellers, a main development with larger aircraft and the improvement in efficiency of the airline industry) are also of relevance.

2.1 Air passenger transport network development, as "regulated" and as "liberalised"

A main feature of accessibility is to be tracked while considering the network development of air services, boosted in general by a home carrier flying according to the interests of the country (a main issue in the past) and own commercial purposes (the operation of a hub-and-spoke system at home).

Setting up a network while dealing with accessibility by air compares with the aim of the Swiss to support as many airlines as possible. Although this goal could be sustained by airlines of neighbouring countries and/or by connecting at foreign airports, direct air links are wished.

Network development is for the home carrier important element of economic development of an airline as it helps to provide an annual growth. New or improved air links are able to increase in revenues in order to match increasing investment and operating costs.

The question arises to a market-oriented airline on whether for the introduction of a new air link a (sufficient) traffic potential exists, whereby not only the point-to-point (local) traffic is

to be considered, but also the connecting traffic (at both points)¹³. A rough estimation is made while comparing the market share of the expected competitors with the market shares at similar competition places between the airline and the competitors¹⁴.

Air passenger transport developed for a country according to international and national rights and duties and as a network of "regulated" services of the designated airline, according to bilateral agreements. A bilateral agreement based on a "fifty-fifty" principle is expected to give a junior partner an advantage of scale.

Another interesting aspect of network development is given by the former colonies having accessed to independence in the wake of World War II. Urging for international recognition, many emerging countries settled air transport agreements with as many countries as possible. They were quite honoured to be visited by prestigious airlines, such as TWA or KLM at that time, but also by Swissair which represented the "virtues" of the home country (and above all Geneva). At that time Swissair was expanding world-wide (Middle East, into the Far East at the end of the fifties and later, into Africa at the beginning of the sixties and later).

The advantage of scale in bilateral agreements evades for the junior partner in the case of competition with the airlines of larger countries such as the neighbouring European Countries and the USA. The fifty-fifty principle was long a disadvantage, as the Swiss company was not authorised to fly to more than 3 destinations in the USA, simply because Switzerland could

¹³ It is worth knowing what air passengers would do if there were an additional alternative to fly to destination. A direct air link without transferring would certainly be taken into consideration. The behaviour of new customer is certainly based on many factors of influence, objective as well as subjective, which are not weighed in the same manner among human beings.

A method to get a better approach on introducing a new opportunity is the so-called "stated preference technique". As it is named the method relies on statements on a string of criteria, such as origin and time of departure, frequencies, fares, airline, connecting aspects, which compared to other alternatives leads to a choice according to the rankings.

A model according to "stated preference" will estimate the number of air passengers to be expected. It needs a complete data set. Using a multinomial Logit model the benefit of each alternative can be estimated.

The results will be validated with a "revealed preference" survey, where the results of survey on the reasons of choice by the air passengers will be taken into account.

¹⁴ For instance comparing the market shares in Los Angeles with the prospect of serving San Francisco.

not offer more than 3 Swiss destinations. Thanks to the "open skies" policy inaugurated by the USA, this constraint was no longer effective, and Swissair was allowed to fly much more destinations than Switzerland could offer. The share in air passengers carried increased for the Swiss carrier in a liberalised context up to 90%, simply because the "Swiss market" was for the US-airlines not worth considering. This should underline the opportunities given to Switzerland in accessibility by air in the USA.

In the wake of deregulation and liberalisation processes in the USA and the EU, a network of "liberalised" services began to start for the designated airlines of the involved countries. Swissair being set apart with regard to EU-liberalisation, due to political reasons, the search began for a solution in order to keep in touch with the international air transport market, in particular the market going to be liberalised within the European Union.

Access to the European liberalised market almost at the same conditions as an EU airline came up with the prospect of a bilateral agreement with the EU.

In the meantime air passenger transport in Switzerland continued to develop as a network expected to have access to "liberalised" services by the way of a merger, alliance, up to the development of (several) hub-and-spoke systems for commercial purposes.

A very important catalysator to accessibility is the operation of a hub-and-spoke system. The principle consists simply on attracting air passengers to transfer them at the company "hubbing" airport from one flight to another flight on their air travel from A to B. This complies well with the geographical location of Switzerland.

In order to improve the attractiveness of its hub-and-spoke system the airline has to cope with a string of conditions. Important are connecting times at the connecting airport as short as possible and as many opportunities a day as possible to transfer from A to B must be supplied in order to be attractive.

Frequent flyer programs and other bonuses will improve fidelisation attempts of the (frequently) connecting air passengers. In order to increase the number of flight departure opportunities, aircraft with smaller capacity will be also flying.

For Swissair, up to 60% of its passengers at Zurich airport was transferring only, that is connecting from one flight to another, without having anything to do in Zurich except that (they

could have transferred in Brussels or at another airport in the same way). So-called "local" air passengers, that are those starting or terminating their journeys in Zurich, are given so much more opportunities in accessibility. Not only in terms of flight frequencies, but also in terms of air links from and to Zurich, which could not have been operated on a successful commercial base without sufficient revenues from connecting passengers on the planes and probably would have to be terminated.

There is space for even better accessibility with the development of multi-hubs¹⁵.

Zurich airport without any or with a reduced hub-and-spoke system will have an impact on the accessibility by air related to Switzerland in general, Zurich in particular (see table)

2.2 Development of the flight departure opportunities and of the number of seats supplied

Flight departure opportunities considering an air link should reflect an adequacy between several purposes. First of all, an airline has to take account of the capacities (number of seats at average comfort) by the manufacturers. If the capacity offered on a short-haul operation may reach from just above one-hundred to just under two-hundred seats (in some exceptions of very high-density seating up to around five hundreds, as the case in Japan), regional aircraft offer between thirty to seventy seats, up to one-hundred. On long-haul operations there are no modern aircraft to be found with less than twohundred seats (at average comfort for long-distance).

The purpose of an air passenger for business purpose on any long-haul flight is to be offered at minimum a daily flight; if demand is not high enough the airline will offer five-weekly flights, which is "almost daily".

On European services, two flights daily (one in the morning and another in the evening) may be considered by business travellers as "poor" an offer; a mid-day flight as well as an early

¹⁵ separately or as a system, like that of the Qualiflyer Group, connecting within the same alliance in Zurich, Brussels, Paris-Orly, Lisbon, Istanbul, Vienna/ Warsaw and at regional hub-and-spoke systems in Nice and at the EuroAirport Basle-Mulhouse-Freiburg

and a late evening flight may be considered as a minimum. The airline will try to match the demand by using if necessary low-capacity regional aircraft.

For leisure destinations (such as to the Mediterranean), a daily flight (at least five weekly flights) will be expected and will be conveniently (for the air passengers as well as for the airlines) distributed during the day (for reasons of time-consuming airport ground access at far origin and/or destination).

Moreover, if the airline is operating a hub-and-spoke system, more connecting flights to long-haul flights will be necessary because most of the long-haul flights have to comply with time-lags on their way to destination via stop-overs and vice-versa and have to arrive at local times according to normal day life.

Foreign airlines will try to do the same, at least in Europe, but according to their hub-and-spoke system (at their home base).

All this together gives for air passengers flying to or out of Switzerland much more flight departure opportunities and more chance to catch a seat (on the day of departure), as an airline operating a hub-and-spoke system will look closely at offering enough seats.

2.3 Development in the reduction of (air) travel time

The development of travel time is the result of overwhelming improvements in technology and reliability, associated in particular with higher speed and range. Technical improvements and adequate traffic volumes made it possible to fly more, farther and non-stop, reducing the (air) travel time quite significantly.

Operation delays, for instance due to air traffic congestion, are not taken into account.

2.4 Development of air travel fares

The continuous reduction in the level of fares in nominal (and real) terms (down to "rock-bottom, if not dumping prices) is the consequence of a fierce competition and lower costs per seat-km. This is in particular due to improvements in the technics (lower energy consumption

per seat-km, higher speeds and higher transport volumes offered), in maintenance (procedures), reliability, professional skills and efficient management.

The fare structure was set in the "regulated" past by the IATA organisation according to reference matrices. Bilateral point-to-point fares were allowed under some conditions, before the "liberalised" fare process came in, which is (internet-oriented) and largely dynamic (according to sale forecast).

3. Case study results related to Switzerland

The case study shows the evolution since World War II (1950, 60, 70, 80, 90, 2000) of the accessibility of Switzerland Zurich by air, limited to the Zurich airport and related for now to some typical locations abroad served by scheduled airlines.

Foreign airport selection: it could be interesting to have all the destinations served just after World War II. Furthermore it could be interesting to have (if possible) a selection of the destinations according to continents and to the status of world agglomerations or not, in the last case having the main activity set as a financial or industrial, cultural or leisure/sport centre. A first reduced selection, showing opportunities for comparison could be in:

- both Americas (New York, Sao Paulo, Rio de Janeiro)
- Asia (Tokyo, Hongkong, Bangkok, Bombay)
- the Middle East (Teheran, Cairo)
- Northafrica (Tunis, Tripolis)
- Europa (all served since just after World War II)

Number of direct return flights per week, number in offered seats one-way per week

Time spent on the most direct flight in hours, including stop-overs on the way to the destination

Number of technical or commercial stop-overs per flight on the way to the destination is that shown in the published timetables

Flight distance in km is taken into account as published by the ICAO statistics

Air fare (in CHF at nominal value) are shown as the cheapest one-way ticket and the cheapest reduced fare on return tickets, which is subject to a string of validity constraints and are not comparable with regard to sustainability, airlines, destinations, age of the air passengers, and

so on¹⁶. Moreover the cheapest tickets are usually contingent. On the other way, one-way-tickets are not comparable either, as there is often a return ticket which is cheaper than the cheapest one-way ticket (!).

For comparison purposes and in a later stage, a similar case study will be attempted with air transport bypassing Switzerland.

¹⁶ Fares in Europe are traditionally in favour of railways. **Return tickets** (no restriction, no reduction in price):

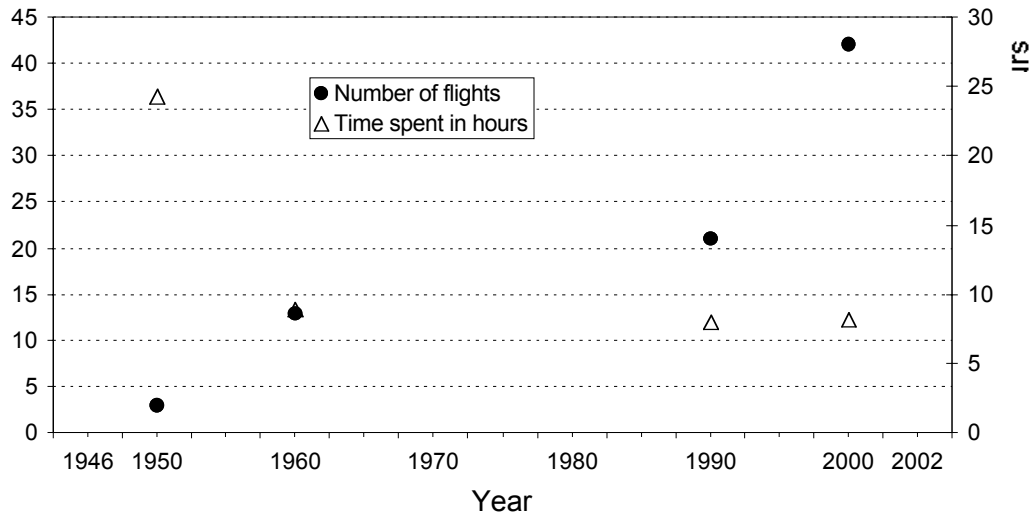
	Classical train (1 st class):	Flight (Business class):
Zurich-Stuttgart:	CHF 190.-	CHF 512.-
Zurich-Munich:	CHF 259.-	CHF 639.-
Zurich-Milan:	CHF 206.-	CHF 886.-
Zurich-Lyon:	CHF 298.-	CHF 780.-

Except an additional compulsory variable charge for seat reservation, the class fare structure on trains has been maintained for TGV-services quite at the start of operations. Airlines have tried to keep flying parts of the passenger market by adapting partly to high-speed train fares, as shown hereunder between Geneva and Paris. This shows air transport attempting to match TGV fares in particular while applying a range of economy class rates (for the same level of service on board).

TGV:	Scheduled flight:
1 st Class : CHF 240.-	Business class : CHF 940.-
1 st Class : CHF 180.-*	Special Business class* : CHF 799.-
2 nd Class : CHF 160.-	Economy class : CHF 848.-
2 nd Class : CHF 120.-*	Special Economy class* : CHF 759.-
	Excursion fare* : CHF 679.-
	SUPERPEX* : CHF 476.-
	SUPERPEX* : CHF 381.-
	SUPERPEX* : CHF 307.-
	SUPERPEX* : CHF 278.-
	EURO fare* : CHF 219.-

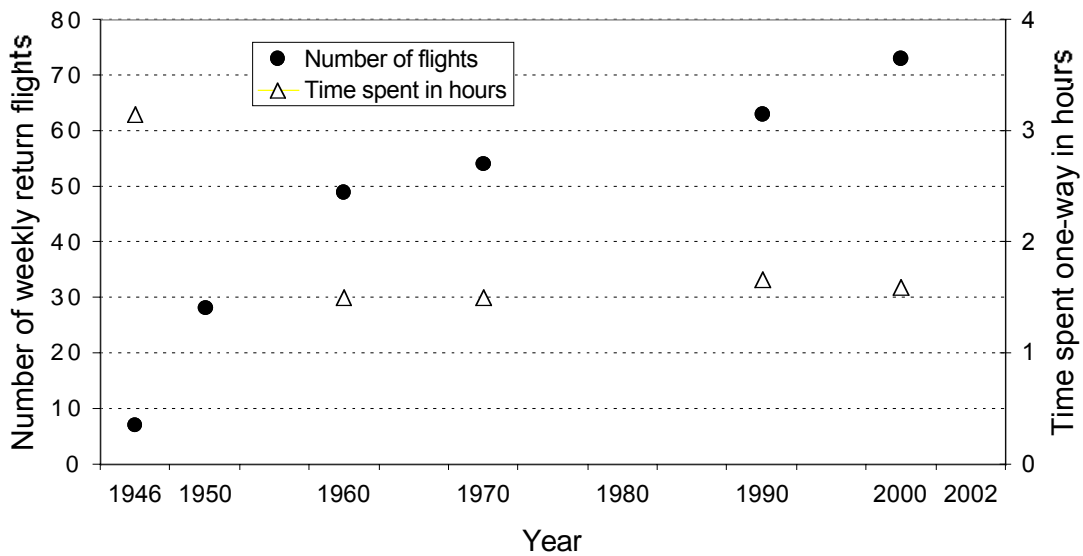
*: depending on (the tightness of) the travel conditions.

Figure 1 Number of direct return flights per week **from Zurich to New York** and time spent one-way in hours on the most direct flight, including stop-overs



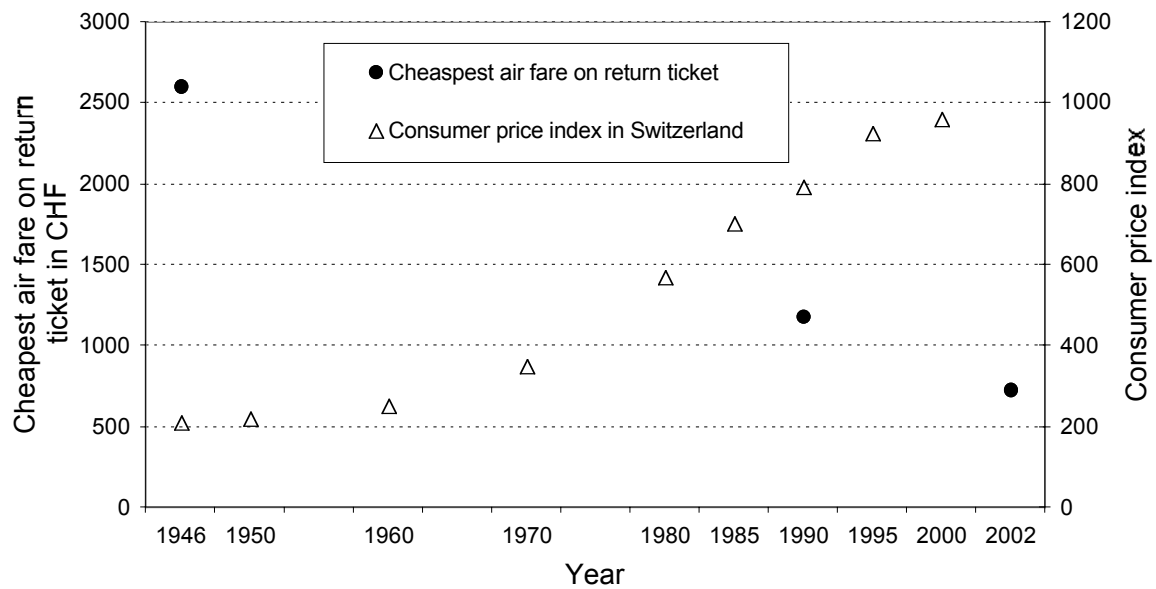
Source: see "References"

Figure 2 Number of direct return flights per week **from Zurich to London** and time spent one-way in hours



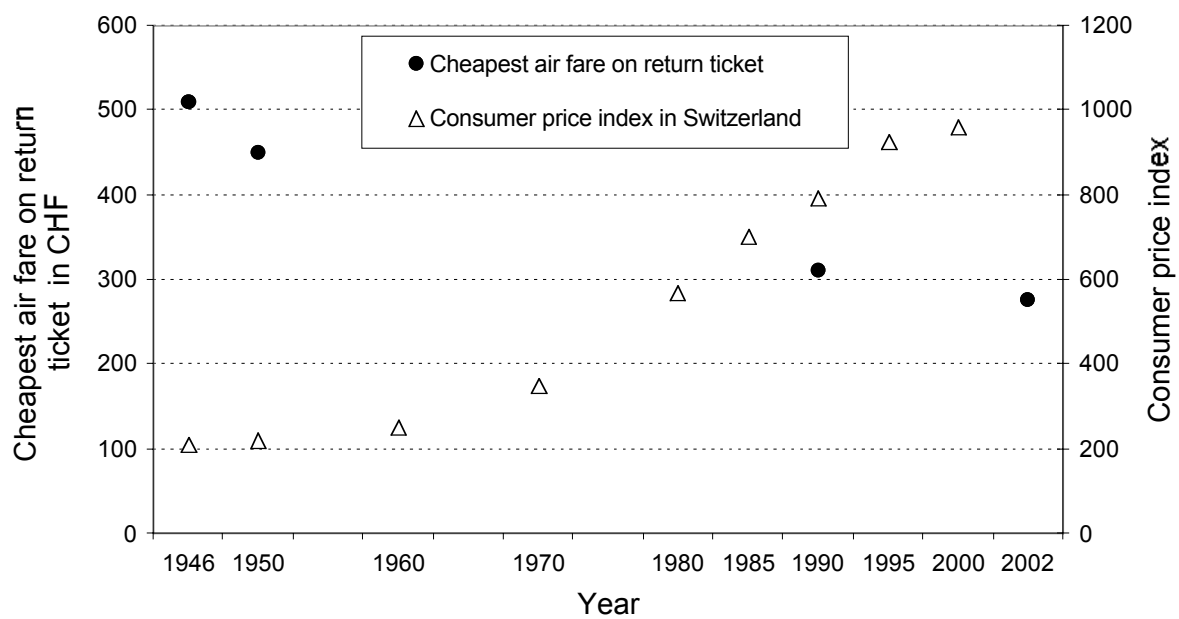
Source: see "References"

Figure 3 Cheapest reduced air fare on return ticket **from Zurich to New York** in CHF (at nominal value) and consumer price index development in Switzerland



Source: see "References"

Figure 4 Cheapest reduced air fare on return ticket **from Zurich to London** in CHF (at nominal value) and consumer price index development in Switzerland



Source: see "References"

The figures show what was mostly expected, that is a drastic increase in the number of flights on an air link, particularly in the nineties, as hub-and-spoke systems operated by most (major) airlines became common also in Europe.

Flight time, on the contrary stagnated since 1960 with the introduction of jets in civil aviation, after having decreased rapidly since World War II.

The cheapest air fares on return air ticket, even at nominal value, decreased steadily up-to-now, due to remarkable efficiency improvements thanks to technology and management skills as already described. The consumer price index development in Switzerland gives a final first glimpse at the improved conditions in real terms with regard to accessibility by air transport since World War II.

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Appendix A: Examples related to accessibility

Some examples found too large or not supporting the understanding of text are reproduced

A 1: Areas of origin and destination of the flights landing and starting at Zurich airport along the day

The table shows the hub-and-spoke system at the Zurich airport according to the areas of origin and destination of the flight landings and take-offs along the day. These movements are the result of a historical development and takes into account in particular the need for connecting intra-Europa flights between them and with long-haul flights, the timetable of which is subject to convenient local times at each place of landing.

Day time	Arrivals from	Départures to
(early) in the morning	Europe, North and South America, Africa, the Near and Middle East, The Indian subcontinent, South-East Asia, Hongkong	Europe
in the forenoon	Europe, North America, the Near and Middle East	Europe, North America, Africa, the Near and Middle East, Pakistan
at noon	Europe, North America, the Near East	Europe, North America, (North-) Africa, the Near and Middle East, India
in the afternoon	Europe	Europe, North America, the Far East (except HongKong)
rather early in the evening	Europe, North Africa, Israël, San Francisco, the Far East (except HongKong)	Europe, New-York
rather late in the evening	Europe	Europe, South America, East and South Africa, South-East Asia, HongKong, the Near East

Source: Autography «Luftverkehrssysteme» ETH Zurich (2002)

A 2: Aspects to be taken into account in network and timetable development at the example of Zurich- Caracas

Starting with the long-term planning process, timetables for long-haul flights are being elaborated, as they are to be incorporated into the aircraft fleet "round-the-clock" rotations. If needed, they are ready to be activated¹⁷.

Much interesting is the collection and synthesis of all aspects involving traffic rights and operations to be taken into account each time a new air link is to be introduced. The example of Zurich-Caracas is summarised as published in Swissair News (7/1985).

The product is called here "timetable". After a preliminary study, if quoted as interesting, a market study and talks on the spot will be started. Once again, if estimates and cost-benefit ratios are positive, a proposition for opening a new destination will be addressed to the executive management. The market research main aspects are described as follows:

Clarifications:	Results:
- Political situation:	stable
- Economic situation:	recover
- Competition:	KLM giving up operations on ZRH-CCS & vv and fifth freedom at the end of march 1985.
- Partnership:	commercial agreement with VIASA
- Traffic rights:	permit only; air transport agreement ¹⁸ to follow
- Sales organisation:	to be set up
- Aircraft type:	DC-10/30 normal version with full-load capacity
- Operational aspects:	"Simon Bolivar" airport extended; ground services by VIASA;

¹⁷ including crew planning and training (as the approach on a new airport) .

¹⁸ the commercial agreement is pooling both once weekly flights of Swissair and VIASA and has been prepared by the section "commercial settlements" and underwritten by the presidents of both companies. The negotiations for an air transport agreement Venezuela/ Switzerland have been conducted by the Swiss Federal Office for Civil Aviation, with the support within Swissair of the co-ordination staff on matters of external affairs and law.

- Frequency/ Days of operation: starting once weekly at 6/7 (Saturday/Sunday) instead of 5/7 (Friday/Sunday); at a longer term intended to be twice a week;
VIASA once weekly (3/5) also with DC-10
- Timetable, routing, connections: ZRH-CCS & vv at peak time for connections

The timetable of an air route like to Caracas and return has to approach the market in taking account of the following factors:

- Take-off and landing times have to be set to allow good connections
- At destination and stop-over places, take-off and landing times have to occur at local times conform to market requests and in particular to available connections
- The timetable has to take into account any blocked time-lag in accordance with operational duties, like for instance dispositions for crew operations
- Take-off and landing slots have to be confirmed along the intended route

According to these considerations, the SR-Caracas-flight took off on Saturdays at the noon-traffic peak, had in Caracas a two hours stop (only) and was on Sundays back at the Zurich airport at the noon-traffic peak with its string of connection opportunities. The operation lasted about 24 hours only, whereby a change of crew had to take place in Caracas¹⁹.

Swissair aircraft for long-haul operations accounted usually (depending on routing and aircraft type and version) for 12 to 15 flying hours a day at an average.

The fact that thorough preliminary work is not a guarantee for success is highlighted by this case too: Swissair had to terminate the service to Caracas on the 1st of February 1992

¹⁹ A return flight with the same crew would have necessitated the following timetable: an outbound flight on Fridays; a 20-hours stay in Caracas; a return flight on Saturdays afternoons (local time); a landing in Zurich on Sundays, in phase with the morning connection opportunities. The DC-10 would have been operated during 42 hours, but with a whole crew less (waiting for the next flight).