



# Air transportation demand forecasts in emerging market economies: a case study of the Kyrgyz Republic in the former Soviet Union

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## Abstract

This paper describes an approach to forecasting air transportation demand that was performed as part of a feasibility study for the rehabilitation of Bishkek-Manas International Airport located in Bishkek, the capital of the Kyrgyz Republic. Since its separation from the former Soviet Union in August 1991, the Kyrgyz Republic has begun a transition from a planned economy to a market-based economy. To promote economic development and to become competitive in a worldwide market economy, the government of the Kyrgyz Republic has initiated a program to modernize its aviation system. The forecasting methodology differs from typical forecasting approaches because the historical information on air traffic that occurred under the planned economy is no longer relevant to future air transportation demand in a market-based economy. Because the development of Kyrgyz economy and the role of air transportation in this development will depend on future decisions and policy choices, an estimate of the likely range of traffic levels was needed to estimate both the extent of the facilities that could be required, and the ability to pay for them. Thus, the forecasts prepared for the feasibility study were based on several alternative economic development scenarios that reflected different strategies that might be issued to foster economic growth. These included tourism, resource extraction, and development of an airline hub or foreign trade zone. Using data from 30 countries at varying stages of economic development, models were developed that related air passenger and air freight traffic to aggregate domestic product. These models then were applied to alternative scenarios of economic growth rates for the Kyrgyz Republic to develop a range of forecast traffic levels. The impact of different development strategies on growth of gross domestic product was estimated, and compared to the growth assumptions in the alternative scenarios. © 1998 Elsevier Science Ltd. All rights reserved.

**Keywords:** Aviation demand; Forecasting; Emerging market economies

## 1. Introduction and background

The Kyrgyz Republic is located in south central Asia between China and Kazakhstan. The land area of 198 500 km<sup>2</sup> is approximately the size of the state of South Dakota in the United States. As shown in Fig. 1, the Kyrgyz Republic is bordered on the north by Kazakhstan, on the west by Uzbekistan, on the south and west by Tajikistan, and on the east by China.

Formerly, part of the Soviet Union, the Kyrgyz Republic adopted a formal constitution on 5 May 1993 and since then has begun a transition from a planned econ-

omy to a market-based economy. The transition has not been easy, as witnessed by a 25% decrease in the gross national product (GNP) in real terms. The inflation rate has been increasingly unstable and reached levels as high as 29% per month in the first-quarter of 1993 (US Central Intelligence Agency, 1993). This has had a significant effect on air fares, which have increased rapidly, resulting in a marked decrease in air travel throughout the Kyrgyz Republic.

To develop trade within the international marketplace, and to become competitive in a worldwide, market-based economy, the Kyrgyz Republic must improve its airport and airspace infrastructure. Deterioration of the airport pavement and other infrastructure has resulted in significant safety and liability problems. The past few years also

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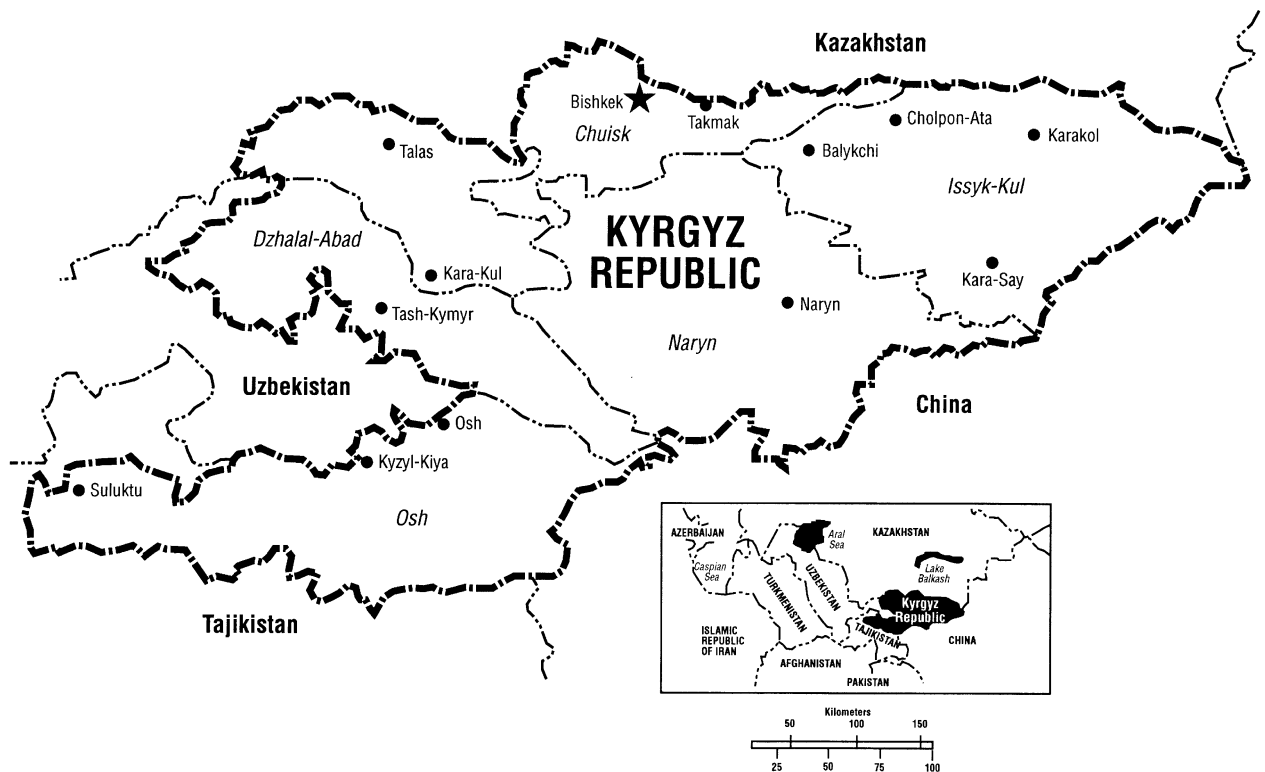


Fig. 1. Kyrgyz Republic.

have seen sporadic air service in the Kyrgyz Republic because of fuel and parts shortages that have grounded aircraft and long suspensions of service were common.

As fuel prices in the Kyrgyz Republic approach world prices, it is likely that air travel and air freight costs will continue to rise, resulting in decreased demand for these services. Before the breakup of the Soviet Union, a one-way flight from Bishkek, the capital of the Kyrgyz Republic, to Moscow could be purchased for the equivalent of 7 United States dollars (USD). At the beginning of 1994, the same flight from Bishkek to Moscow cost approximately 70 USD. Therefore, planning appropriate steps to modernize and rehabilitate the airport and aviation infrastructure must take into account these constraints. The scale of proposed improvements, and the ability to pay for them, depend on the expected future traffic growth, as the Kyrgyz economy recovers from its current difficulties.

This paper describes the development of forecasts of air transportation demand that were prepared as part of a feasibility study for the rehabilitation of Bishkek–Manas International Airport located in Bishkek, in the north central portion of the Kyrgyz Republic, as shown in Fig. 1, near the border with Kazakhstan.

Typically, master plan documents evaluate an airport's needs based on a single forecast. Alternative airport development options then are assessed based on this fore-

cast. This study took a different approach by defining and analyzing several different scenarios for the economic development of the Kyrgyz Republic, each of which may imply separate development scenarios for the aviation system. These scenarios then were used to define the range of future traffic demand that could occur at the airport.

## 2. Recent pattern of air traffic demand

Because of the changes since the breakup of the USSR, historical information regarding air transportation activity throughout the Kyrgyz Republic was extremely limited. Thus, an analysis of existing conditions focused on Bishkek–Manas International Airport. At the time of the study, scheduled flights primarily served domestic destinations and a few cities within the Commonwealth of Independent States (CIS), as shown in Fig. 2. Except for Osh, Moscow was the city most frequently served (three flights per week). Charter flights, however, constituted a significant portion of aviation activity.

### 2.1. Passenger and freight movements

Fig. 3 shows the significant decline in passenger and freight traffic that followed both the move to independence and the shift to a market-based economy. Total

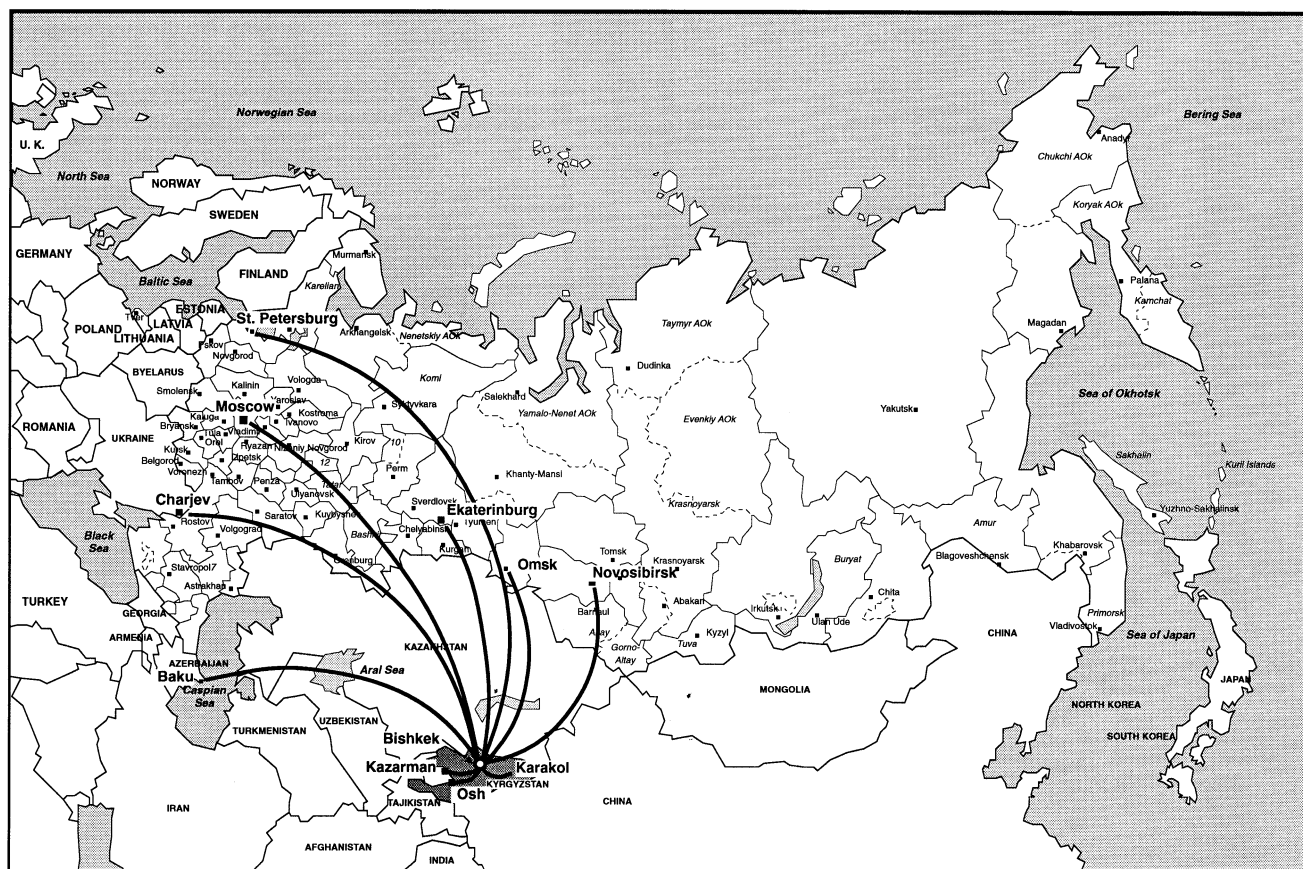


Fig. 2. Existing Kyrgyz Republic scheduled air transport route network.

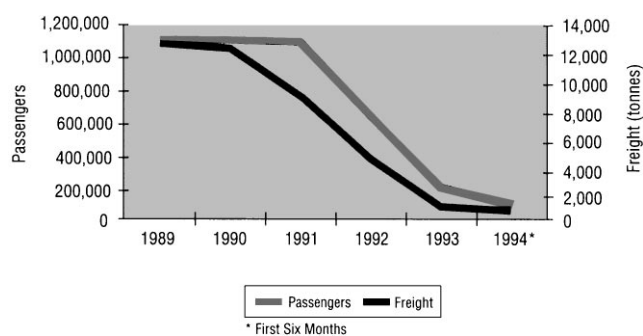


Fig. 3. Passengers and freight Bishkek–Manas International Airport.

passenger trips fell from 1.7 million in 1991 to less than 300 000 in 1993, representing a reduction from 0.42 trips per capita to 0.08 trips per capita. Freight traffic exhibits a similar pattern.

Prior to the breakup of the former Soviet Union (FSU), air travel was heavily subsidized, so that even persons with relatively low incomes could afford to travel. As the country moves to a market-based economy, prices are rising to become more closely aligned with production costs. Air fares have been rising significantly

Table 1  
Real wages – 1993

1993	Percent change from previous quarter	
	All sectors	Industrial sector
1st quarter	– 37.1	– 28.2
2nd quarter	– 9.2	– 5.9
3rd quarter	– 17.7	– 19.7
4th quarter	– 15.3	– 16.2

Note: Sources: EIU, 1994; OECD, *Short Term Economic Indicators: Transition Economies*.

in real terms, while real incomes have been falling, as illustrated in Table 1. Aside from these price and income elasticity effects, the economic and political transitions may also have reduced the need for travel within the CIS, as traditional governmental, management, and trading relationships shifted away from Moscow and other major centers within the FSU, and new relationships have not yet evolved.

At the time the forecasts were prepared, the decline in air transportation demand appeared to have bottomed out, with passenger traffic levels for 1994 similar to those for 1993, and freight traffic showing a small increase.

The largest component of passenger traffic is domestic travel to other communities within the Kyrgyz Republic, which accounted for 60% of enplaned passengers in the first 6 months of 1994. Passengers to destinations in the CIS accounted for 24%, while those to other foreign destinations accounted for approximately 14%. General aviation accounted for about 2% of enplaned passengers. The shares of both domestic and foreign passengers increased from 1993 by 6% and 4%, respectively, while the share of CIS passengers declined by about 8%.

About 80% of the passenger traffic used the national airline (Kyrgyzstan Aba Zholdaru) during the first half of 1994. The composition of scheduled traffic is shown in Fig. 4. Traffic to destinations within the CIS was growing faster than domestic traffic within the Kyrgyz Republic, although domestic traffic also was increasing. Some scheduled traffic to other international destinations appeared in the later months of the period with the introduction of service to Istanbul.

The composition of nonscheduled passenger traffic showed a very different pattern. The majority of non-scheduled traffic was to destinations external to the CIS, with only about 20% to CIS destinations and under 3% within the Kyrgyz Republic. While nonscheduled flights accounted for less than 1% of domestic traffic and 11% of traffic to CIS destinations, some 93% of traffic to international destinations used non-scheduled flights.

The enplaned freight traffic at Bishkek–Manas International Airport during the first 6 months of 1994 showed a much smaller share of the traffic accounted for by domestic shipments (only 30%), with 46% to republics within the CIS and 19% to foreign countries. General aviation accounted for 5% of enplaned freight. In contrast to passenger traffic, imbalances of inbound and outbound freight commonly exist, reflecting differences in commodity trade flows. Thus, only measuring en-

planed freight may be misleading. Exports from the Kyrgyz Republic mostly involve commodities that typically are not shipped by air, while disruption of traditional supply lines from the FSU may have resulted in a significant increase in imports by air. Anecdotal evidence suggests that merchants often charter aircraft to fly to foreign countries and return with goods for internal distribution.

The freight traffic during this period showed a strong directional imbalance, as indicated by Fig. 5. While the airport handled a higher proportion of inbound freight during the period, the volume of outbound freight grew considerably toward the end of the period, and by June 1994 outbound volume had surpassed the inbound volume. The domestic share of inbound freight appeared to increase during the period, while that from CIS origins has tended to decline. The volume of international freight fluctuated monthly, and it was not obvious whether this volume was increasing or not.

A summary of passenger and freight traffic at Bishkek–Manas International Airport from January to June 1994 is provided in Table 2.

### 3. Socio-economic overview

The Kyrgyz Republic shares cultural ties to the CIS and the economic cooperative organization (ECO) states consisting of Iran, Turkey, Pakistan, Uzbekistan, and Kazakhstan. These cultural ties form the basis for the continued growth of the Kyrgyz Republic's economy as it tries to recover from the present state of economic disequilibrium. The Kyrgyz Republic has also developed a strong trading relationship with China.

The estimated population of the republic in 1993 was 4 626 000, 62% of whom live in urban areas. The population is growing at approximately 1.6% per year, although

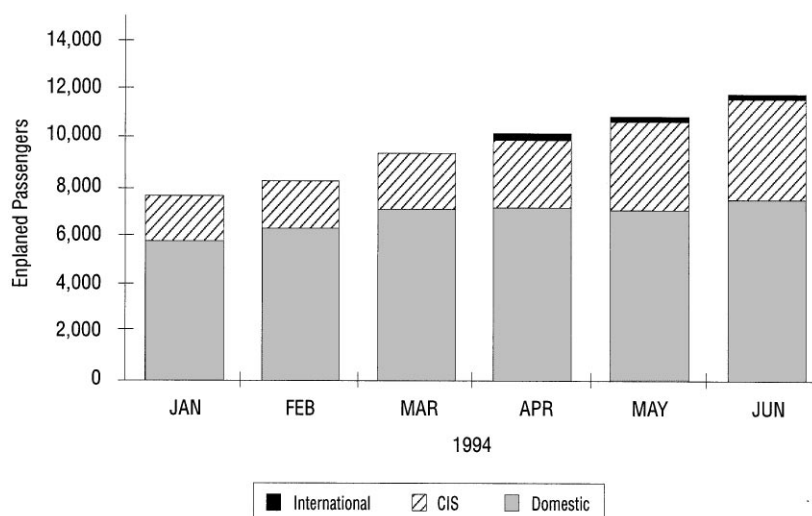


Fig. 4. Bishkek–Manas International Airport scheduled traffic.

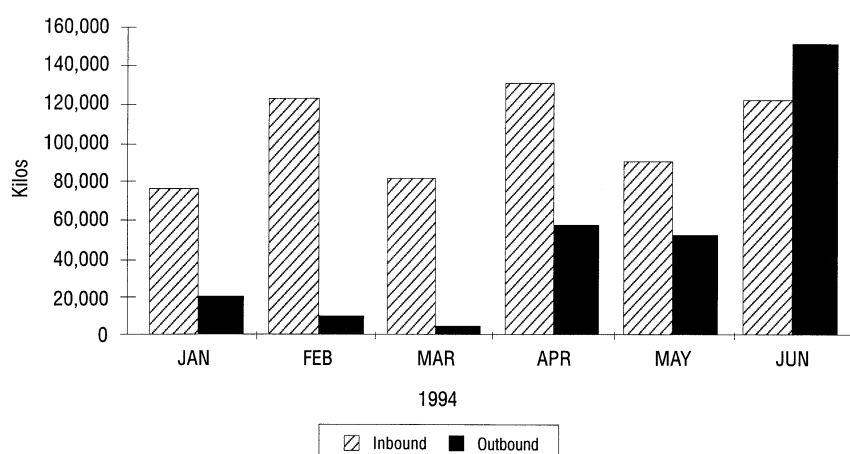


Fig. 5. Bishkek-Manas International Airport freight traffic.

Table 2  
Traffic at Bishkek-Manas International Airport first 6 months of 1994

Activity	Enplaned passengers	Enplaned freight (tonnes)	Deplaned freight (tonnes)
Normal airline	83 744	431.9	1 351.7
Other CIS airlines	3 060	3.2	11.5
Foreign airlines	N/A	N/A	N/A
General aviation	2 188	24.5	51.7
Total	88 992	459.6	1 414.9

Note: N/A = Not available.

there is a net annual out migration rate of 3.6 per 1000 population, with the majority emigrating to Russia. The capital of the Republic, Bishkek (formerly named Frunze), is located near the Republic's northern border with Kazakhstan and has a current population of approximately 600 000. The rural population is located predominantly in agricultural valleys throughout the country and consists primarily of ethnic tribes, some of which continue to be nomadic. (US Central Intelligence Agency, 1993).

The ethnic composition is 52% Kyrgyz, 22% Russian, 13% Uzbek, and a wide national diversity making up the remaining 13%. The country is predominantly Muslim, accounting for an estimated 70% of the population, resulting in strong ties to the other members of the ECO States (US Central Intelligence Agency, 1993).

While less than 7% of the total land area can be irrigated, the economy is oriented toward agriculture, based primarily on livestock such as goats, sheep, and cattle, and on crops such as cotton, grain, tobacco, vegetables, fruits, berries, and potatoes. At the present time, the Kyrgyz Republic cannot sustain enough agricultural production and must import food.

The republic's industrial and manufacturing output is concentrated near Bishkek, and includes domestic appli-

ances and small machinery, agricultural and food processing equipment, textiles, furniture, cut logs, cement, paper and bricks. Mineral extraction, in the form of coal, rare earth metals, and gold, currently is limited, but holds some of the highest potential for development according to many Western experts. The Kyrgyz Republic also is rich in hydroelectric power and is a net exporter of power.

Primary exports to Russia, the Ukraine, Uzbekistan, and Kazakhstan, among others, include wool, chemicals, cotton, ferrous and nonferrous metals, shoes, machinery, and tobacco. The Kyrgyz Republic's primary imports, largely from other republics within the CIS, include lumber, industrial products, ferrous metals, fuel, machinery, textiles, footwear, and food. Fuel shortages and poor infrastructure among neighboring countries have contributed to continued declines in agriculture and industry.

As the government moves to a market-based economy, it has privatized business, assisted farmers in continuing agricultural production, and has opened the republic's investment to outside developers.

As fuel costs in the CIS began to reach world market prices, both individuals and transportation agencies have found it increasingly difficult to pay for fuel, while countries such as the Kyrgyz Republic have experienced problems generating the hard currency necessary to import fuel. These problems are compounded by poor infrastructure, such as leaking pipelines and roadways that are not capable of withstanding fuel truck loadings.

The current production of oil in the Kyrgyz Republic is somewhat limited. In 1991, the Kyrgyz Republic produced 3600 barrels of oil per day, compared to a total demand for petroleum of 25 000 barrels per day (Intrasearch, Incorporated, 1994). Thus, the republic must import a significant amount of oil from its CIS neighbors. International oil companies have estimated that the Kyrgyz Republic currently possesses oil reserves in

excess of 100 million barrels in 10 fields (Intrasearch, Incorporated, 1994), constituting an 11-year supply at current consumption rates.

The country has over 30 000 km of highway, 75% of which are paved. The most significant roadway consists of the Karakoram Highway that connects the Kyrgyz Republic with Kazakhstan and China. Approximately, 370 km of railroad lines are located primarily in the north near Bishkek. Only 200 km of natural gas pipelines exist; no usable oil pipelines are known to exist within the Kyrgyz Republic's borders. According to the World Factbook (US Central Intelligence Agency, 1993), there are 27 usable airports, 12 of which have permanent surface runways. Only Bishkek–Manas International Airport has a runway longer than 4000 m.

#### 4. Economic development scenarios

To account for the range of possible economic development options that the government of the Kyrgyz Republic might pursue, each of which would affect future levels of air traffic in different ways, air traffic forecasts were based on a set of alternative scenarios reflecting the following economic development options:

- *Resources extraction:* Anticipated development of gold, rare earth metals, hydroelectric power, coal, petroleum, and natural gas, will induce origin–destination air travel demand for flights within the Kyrgyz Republic as well as transborder flights.
- *Tourism:* Tourist development potential appears to exist within the Kyrgyz Republic, in the spectacular Tien–Shen mountains and around the scenic Lake Issykkul. As tourist infrastructure develops and the opportunities become better known outside the country, air travel demands similar to those experienced in Nepal could occur.
- *Refueling point:* Strategically located near air routes between Europe and the Pacific Rim, the 4200 m runway at Bishkek–Manas International Airport could serve as a refueling point for cargo aircraft, allowing greater payloads and reduced fuel weights.
- *Trade expansion/airport hub:* As trade develops with the CIS, ECO states, and China, the Bishkek–Manas International Airport may be located strategically to support the development of a hub-and-spoke air route network.
- *Foreign trade zone (FTZ):* The feasibility of creating an FTZ near the Bishkek–Manas International Airport currently is being considered by the Kyrgyz government. If successful, such a development would stimulate increased air cargo traffic, as well as some related growth in passenger traffic.

These development options encompass different time schedules. For example, the development of Bishkek–Manas International Airport as a hub-and-spoke airport

will most likely take more time and will be subject to greater outside forces (competition and governmental policies) than origin–destination scenarios such as the development of mining within the Kyrgyz Republic.

Considerable attention was given to the economic assumptions behind these scenarios to ensure that they are economically viable, and to put the resulting traffic estimates into a context that can be related to other economic development decisions.

#### 5. Air transportation demand forecast

Given the Kyrgyz Republic's current economic disruption and the changes that are likely to occur, it seems reasonable to base air traffic forecasts on activities expected in the future as the economy evolves in a direction similar to other market economies rather than on the current patterns of economic activity and air travel. The evolution of the Kyrgyz Republic's economy and its trading patterns will be subject to events and forces that cannot be predicted with any certainty. In addition, the economic development and the role of air transportation in this development will depend on future policy choices, affecting not only economic development, but also the evolution of the air and surface transportation sectors, and the structure of the airline industry. Therefore, what is needed to support rational decision making is an estimate of the likely range of traffic levels, and an indication of how this range will be influenced by the way the economy develops.

Because this cannot be determined by analyzing the historic pattern of air travel in the Republic, the forecast approach adopted was to develop a model of air travel demand based on a cross section of countries representing the type of economic structure that the Kyrgyz Republic can be expected to experience in the future.

Further, because Bishkek–Manas International Airport is the principal airport serving the Kyrgyz Republic and its capital, the forecast traffic growth at the airport should consider what is happening in the Republic as a whole. Indeed, much of the traffic at the airport may originate or terminate in other communities within the Republic, and thus depend on the economic development of the entire Republic.

Therefore, the forecast approach first projected the total amount of air travel likely to be generated by the Republic before determining how much of this would occur at the airport. This approach is both a theoretical and practical necessity. Most of the data needed to support the forecasting process are available only at the national level, while the demand models adopted in the analysis predict national, not airport, traffic. Once national totals have been projected, the traffic at individual airports can then be determined by projecting the share of the traffic that will occur in each market. Far from

being a limitation of the analysis, this approach recognizes the interconnected nature of the air route system.

### 5.1. *Market competition between airports*

As economic development moves toward a market-based economy, airline route structures will face significant changes. Based on the experience of Western countries, operational considerations will lead to the development of hub-and-spoke networks. Airports strategically located in the larger countries (such as Russia), and the capitals of some of the smaller countries of the FSU, will most likely develop hub-and-spoke operations some time after the year 2000.

As airlines develop hub-and-spoke operations, competition among airports for long-haul connecting passenger traffic will occur. Nearby airports also will compete for cargo traffic. Some FSU airports have natural advantages in providing expanded air service because of the population within the airport service area, the availability of skilled labor, the location of the airport in relation to principal airways and significant great circle routes, and the availability of adequate infrastructure. For example, Moscow, Novosibirsk, and St. Petersburg possess significant hub potential because of fuel availability, the population and employment base in the region, and their location in terms of long-haul cargo routes.

Bishkek's proximity to well developed passenger airports in Almaty (Kazakhstan) and Tashkent (Uzbekistan) also presents a challenge to compete for passengers. Each of these airports is served by several international airlines that offer scheduled services (approximately eight flights per week at Almaty and approximately 37 flights per week at Tashkent) to destinations outside of the CIS. Bishkek–Manas International Airport currently only serves scheduled activity to the CIS, and some chartered passenger and air cargo flights to both CIS and international destinations. Thus, Bishkek already lags behind the more highly developed airports at Tashkent and Almaty, emphasizing the need to critically evaluate the air transportation demand induced by providing upgraded facilities at Bishkek–Manas International Airport.

### 5.2. *National passenger and cargo demand*

The goal of the forecasting methodology was to develop passenger and freight demand projections that were consistent with the economic development scenarios. This meant that the forecasts were to consider both the changes in the aggregate level of economic activity as well as the composition of that activity. The economic scenarios contain differential growth rates for different sectors of the economy with each sector having differing propensities to use passenger and freight aviation. Forecasts need to consider both of these influences, and there

are two ways to accomplish this. If there are data available on the level of economic activity in each sector of the economy and the corresponding contribution to air transportation demand, these data can be used to project the impact of each sector on demand for aviation services. If data are not available at this level of detail, the forecasts can be developed using aggregate data, and alternative scenarios for the economy's development can be reflected in the growth rates assumed in the future. Clearly, the former approach is preferred, but is contingent on the availability of the relevant data.

Using either approach for the Kyrgyz Republic simply was not possible. First, there were not consistent data over a length of time that would permit a forecasting model to be estimated. Second, the country and economy were in transition, and this disequilibrium was reflected in the data. Because our interest was in understanding the demand for aviation services into the future, we selected an alternative approach consistent with an assumption of stable future economic and political activity.

The approach taken in developing the forecasts was to assemble a large data set from approximately 30 countries throughout the world, selected to reflect a broad cross section of aviation activity, size, and development level. The United States was excluded because it would dominate such a data set. This data set contained information on passenger and freight activity; the level of economic activity in general; a number of economic indicators in such sectors as agriculture, manufacturing, construction, mining, and services; and the volume of imports and exports.

The passenger and freight activity data were derived from national statistics published by the International Civil Aviation Organization (ICAO, *Civil Aviation Statistics of the World*, 1993). Economic data were derived from periodic publications of the Organization for Economic Cooperation and Development as well as publications of the World Bank (*International Bank for Reconstruction and Development [IBRD]*).

From this macroeconomic data set, an econometric model was developed in which the level and type of aviation activity were related to the level of economic activity. This approach generated forecasts for the Kyrgyz Republic assuming a relatively stable, market-based economy, which does not differ significantly from other market economies around the world.

### 5.3. *Passenger forecast model*

Our initial approach used the database from 34 countries to estimate the impact of both aggregate and sectoral level of economic activity on passenger demand. The economic sectors were selected to be consistent with the development scenarios described earlier. Unfortunately, the data were not sufficiently robust to yield

Table 3  
Passenger forecast model

Variable	Coefficient	Standard error	T statistic
Constant	– 10.664	0.66787	– 16.00
Ln (GDP/N)	1.1043	0.07203	15.00

Note: Dependent variable: Ln (Passenger/N), GDP = Gross domestic product (in USD million), N = population of the country, Number of data points = 34,  $R^2$  (Coefficient of determination) = 0.876.

consistent and significant estimates. Therefore, we explored a number of alternative functional relationships between the aggregate level of passenger demand and aggregate economic indicators. We settled on a model with per capita domestic economic activity expressed as gross domestic product (GDP) per person as the best explanation for the level of passenger demand. This relationship is shown in Table 3.

The model implies that a 1% increase in GDP per capita will result in a 1.1% increase in the number of enplaned passengers per capita.

It can be seen that the estimated coefficients are highly significant and the model provides a good overall fit to the data (coefficient of determination almost 0.88). It seems reasonable to assume that the variation in the relationship across countries (the ‘error terms’ in the model) are likely to be due in large part to differences in the sectoral composition in their economies. For example, tourist-oriented economies can be expected to generate higher volumes of traffic relative to GDP than resource-extraction based economies. However, these effects appear to be masked in the data by other distortions, such as the unknown influence of income distribution or the split between travel by residents of the country and that by visitors to the country.

In spite of these limitations, the overall fit of the model suggests that it will still give adequate predictions for the purpose of the current forecasting effort.

#### 5.4. Freight forecast model

The freight forecasting model also used GDP as the predictor variable. The relationship between freight traffic and GDP for the countries in the database is illustrated in Fig. 6. A number of alternative models was investigated that included measures of trade activity as explanatory variables and different functional forms, including linear, polynomial, and log-linear. The model with the best statistical fit is shown in Table 4. This model also indicates that for each percent rise in GDP, the level of freight traffic will rise by marginally over 1%.

While the statistical fit of the model is not quite as good as the passenger forecast model, the coefficients are still highly significant and the coefficient of determination shows a fairly good overall fit to the data, as could be expected from the distribution of the data points shown in Fig. 6.

#### 6. Forecast scenarios

Economic indicators for the period 1985–1993 demonstrate the impact of the dissolution of the USSR and the turmoil resulting from the subsequent political, social, institutional, and economic restructuring. Recent growth rates in the overall economy and forecasts for the near-term recovery projected by the World Bank are shown in Table 5.

To account for the effect on air traffic of possible development patterns, it is desirable to analyze different scenarios that span the likely range of future traffic growth. Three scenarios were defined for the current study each reflecting varying assumptions on the development of Kyrgyz Republic’s economy and air service. The forecast scenarios and their associated assumptions are discussed below:

1. Baseline: The baseline scenario assumes that the composition of the Kyrgyz Republic’s economy remains

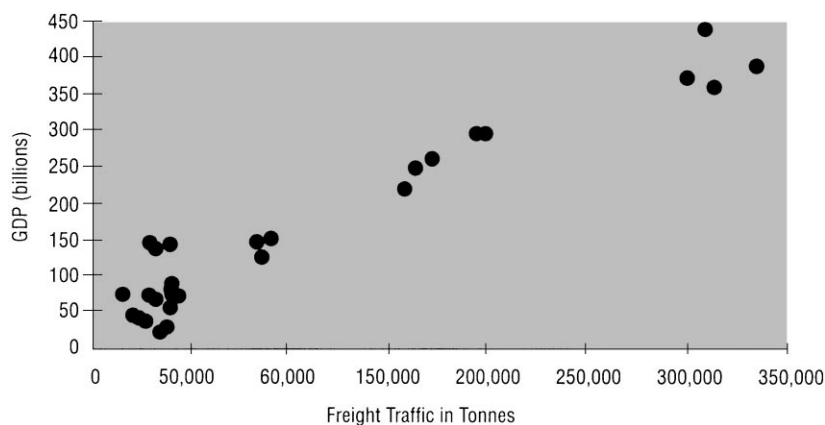


Fig. 6. The relationship between GDP and freight traffic.



Table 4  
Freight forecast model

Variable	Coefficient	Standard error	T statistic
Constant	5.9404	0.72391	8.21
Ln (GDP)	1.0463	0.1536	6.81

Note: Dependent variable: Ln(Freight) (000s, tonnes), GDP Gross domestic product (in USD million), Number of data points = 34,  $R^2$  (Coefficient of determination) = 0.769.

Table 5  
The Kyrgyz Republic actual and forecast economic growth summary

Economic variable	Actual			Forecast	
	1991	1992	1993	1994	1995
Real GDP growth	– 3.9%	– 24%	– 12%	– 2–0%	2–4%
– Agriculture	– 9.1%	0%	0%	2–3%	3–4%
– Industry	0.3%	– 25%	– 18%	– 5–8%	1–3%
Inter-republic exports	—	—	—	—	5%
Inter-republic imports	—	—	—	—	8–9%
Foreign exports	—	—	—	—	30%
Foreign imports	—	—	—	—	0%

Note: Source: IBRD, *Kyrgyzstan: The Transition to a Market Economy*, 1993, p. 31.

much the same as it was in 1990. This scenario assumes that the decline in real GDP experienced since 1993 bottoms out in 1995, and is followed by a real growth of 3% per year. This is consistent with likely growth rates suggested by the World Bank (IBRD, 1993).

2. Slow growth: This scenario assumes that recovery takes longer than projected in the Baseline scenario. Real GDP continues to decline in 1995 and 1996 although at slower rates, and bottoms out in 1997. Real growth does not resume until the year 2000, increasing at a rate of 2% per year thereafter.
3. Strong recovery: This scenario assumes that real GDP growth rates increase steadily from 3% per year in 1995, to 6% per year in 1998. Real growth remains at this level until GDP has returned to the 1991 level in year 2003, then declines to 4% per year thereafter. To put these scenarios into a context of specific economic development scenarios, and to identify factors that could result in different levels of GDP growth or air travel, a range of alternative development strategies was examined:

#### 6.1. Tourism growth

This strategy is based on the development and promotion of the country's tourist attractions, principally mountain resorts. As the economies of the republics

within the CIS recover from the current restructuring, large numbers of people will be seeking recreational opportunities. At the same time, there is a growing number of people in developed countries who are attracted to adventurous vacations in new environments.

Obviously, the potential for tourism varies widely from country to country based on the attractions of the host country, and the size, wealth, and distance of countries from which the tourists might come. To better understand the potential for tourism in Kyrgyz Republic, an analysis was performed of tourist traffic to four countries that offer similar physical attractions to the Kyrgyz Republic: Nepal, New Zealand, Norway, and Switzerland.

Over the 10-year old period from 1981 to 1991, the number of tourists increased at an average rate of a little less than 2% per year for Norway, and under 1% per year for Switzerland. In contrast, both Nepal and New Zealand experienced a growth of tourism averaging a little over 6% per year for Nepal, and over 7% per year for New Zealand. These data appear to support the assumption that traditional vacation markets in Europe are becoming saturated, and that more adventurous travelers are looking for new destinations.

In 1991, tourists from European countries accounted for 40% of foreign visitors to Nepal, or about 120 000 persons per year. Analysis of this strategy assumed that the Kyrgyz Republic is able to achieve a comparable level of European tourists over a 10-year period from 1995 to 2005, with the number increasing at 6% per year thereafter. In addition, it was assumed that the level of visitors from the CIS would return to 1991 levels by the year 2005 and grow at 3% per year thereafter, reflecting the assumed growth of the economies within the CIS. These assumptions gave tourist traffic levels close to the difference between the forecast passenger levels under the Baseline and Strong Growth forecast scenarios.

#### 6.2. Resource extraction

This strategy is based on significant growth in the development of the Kyrgyz Republic's natural resources. There are three variations that need not be mutually exclusive:

1. *Minerals*: The Kyrgyz Republic is believed to possess substantial reserves of nonferrous minerals, including gold. In 1990, intra-CIS exports of nonferrous ores and metals accounted for 1.7% of GDP, while hard currency exports accounted for a further 0.2%. If these exports had been valued at world prices rather than domestic prices, their value would have increased by a factor of about 1.6. Mineral production in 1991 was estimated by the World Bank (IBRD, 1993) at about 46 million USD in world prices, or about 4.8% of GDP. Thus, even a significant expansion of mineral production will only have a modest effect on GDP. Furthermore, with the exception of gold, world

markets for the minerals currently produced are modest in size.

Analysis of this strategy assumed that 1995 mineral production would equal 1991 production, with a 25% annual growth increase in gold production until the year 2005, declining to a constant production rate by the year 2010 and remaining at this level thereafter. Production of all other minerals, except uranium oxide (which would remain at 1991 production levels), would increase by 10% per year. If mineral prices remain at 1991 world price levels while the rest of the economy develops according to the Baseline scenario, the growth rate of GDP would increase over the Baseline scenario between 0.1% and 0.2% per year between 1995 and 2010, reflecting the fact that the increase in mineral production barely exceeds the overall growth of the economy.

2. *Hydropower*: As a mountainous country, the Kyrgyz Republic has abundant sources of hydropower. At present, exports of power are limited by the need to develop generation and distribution capacity, and markets. As the economies of the surrounding states develop, new markets for electricity will emerge. In addition, the Kyrgyz Republic could pursue an industrial development policy that fosters industries that require inexpensive electricity.

In 1990, the Kyrgyz Republic power exports accounted for 0.8% of GDP at domestic prices. However, in the same year, the republic's imports of electrical energy were approximately half the exports, presumably attributable to the interconnected nature of the electrical grid of the Central Asian republics. According to the 1993 World Bank country study (IBRD, 1993), the Kyrgyz Republic's current hydropower capacity of 2.7 GW comprises only 9% of the hydropower that could potentially be generated. Plans have been developed to increase capacity by 6.8 GW, although this planned capacity will not be attained until after the year 2000.

The domestic demand for power will depend on underlying growth in the economy, and changes in energy policy. Substitution of electricity for imported oil and gas would improve the balance of payments, which in turn could be expected to stimulate growth. Hydroelectricity currently provides about 26% of the domestic energy consumption, while oil and natural gas account for about 31% and 21%. About half the oil consumption is used for transportation. In 1991, oil and natural gas imports accounted for over 98% of the respective consumption at a cost of 3.4% of GDP.

Assuming that hydropower substitutes for 15% of oil consumption and 25% of natural gas consumption, this will eliminate an import cost of about 1.7% of GDP at world prices, and increase GDP by an equivalent amount. This substitution will require developing the necessary power generation and distribu-

tion infrastructure, and replacing the oil and gas-fired heating equipment which is likely to be a fairly slow process. It was assumed that such a large-scale transition could not be accomplished in less than 10 years.

Analysis of this strategy assumed that expansion of hydropower production would occur in equal steps from 1995 to 2005. Beyond 2005, hydropower production was assumed to increase at a constant rate to reach 50% of the nation's total potential hydropower capacity by 2020. Substitution of hydropower for oil and natural gas would continue at 2005 levels, and all surplus power would be exported.

The combined effect of the increased power exports and domestic energy substitution would result in a GDP growth of 3.9% per year in 1996, with a 3.1% per year increase by 2013, and 3.0% per year after 2018.

3. *Oil and gas*: The Kyrgyz Republic currently produces a small amount of oil, insufficient to meet the republic's domestic needs. However, there appear to be significant oil and gas resources that are presently untapped, particularly on the border with Uzbekistan. The lack of a way to transport this oil to markets, and the need for external technical assistance in extraction and refining, is limiting the development of this sector.

While the extent of the oil resources are such that a major export market does not appear likely in the foreseeable future, oil and gas imports are currently a major factor in the Kyrgyz Republic's adverse balance of trade. Unless domestic production can be increased, this is likely to become an even greater problem as prices in the CIS adjust to world market levels. Therefore, it is reasonable to develop domestic production capabilities with the initial goal of achieving a positive balance of trade in oil and gas products, and a longer-term objective of expanding exports to the extent that the oil reserves and market conditions allow.

Analysis of this strategy assumed that the country would become a net exporter of oil and gas products by 1999, and that by 2000 sufficient pipeline capacity would have been constructed for oil and gas production to increase by 10% per year for the next 10 years, with the growth rate decreasing steadily thereafter. The effect of the shift of a positive trade balance of oil and gas would result in a GDP growth of 4.9% per year in 1996, decreasing to 3.7% per year by 2002. Thereafter, the growth rate would increase again to 4.0% in 2008 and 2009, then decrease steadily to between 2.5 and 2.6% per year from 2014.

### 6.3. Foreign trade expansion

This strategy assumes a significant increase in foreign trade from the growth rates assumed in the Baseline

scenario. This has two consequences. The first is that the increase in trade will stimulate a corresponding increase in the domestic economy in accordance with classic economic development principles, and the resulting growth of the total economy will generate an increase in air transportation. The second is that the shift in trading relationships will affect the air traffic growth rates in different markets.

In 1992, inter-Republic trade accounted for 88% of exports and 95% of imports, while the Kyrgyz Republic had achieved a small positive foreign trade balance with countries outside the CIS. Foreign trade, measured in USD, increased by about 50% in 1993 over 1992, with imports increasing slightly more than exports. The World Bank study (IBRD, 1993) projected foreign exports to increase about 40% in 1993, with growth slowing to about 15% per year through 1995. Analysis of this strategy assumed that foreign trade continued to grow 50% in 1994, with the growth rate slowing thereafter by 5% per year until 2004 when it would stabilize at the long-term growth rate of the Baseline scenario (3%). Furthermore, half of this trade increase was assumed to replace trade with the CIS, with the other half representing an increase in trade over that which would occur with the Baseline scenario.

Based on the current relationship between trade and GDP, this would result in a forecast of GDP similar to that under the Strong Recovery scenario.

Changes in the pattern of trading partners alters the potential to develop a hub-and-spoke network over Bishkek. The location of Bishkek at the southern edge of the route network limits the potential to carry connecting traffic as long as most air service from Bishkek is to cities within the CIS. However, the development of air routes to countries to the south opens the possibility of carrying traffic via Bishkek between those countries and cities within the CIS. The small traffic flows likely between any given city pair would tend to favor such a hub-and-spoke operation. Similarly, the development of air routes to China could generate east-west connecting traffic flows with countries to the west such as Turkey, and to cities in the western CIS.

#### 6.4. Other development strategies

In addition to broader economic development strategies, the potential exists to pursue airport-related strategies that could generate increased air traffic activity.

1. *Cargo stopover*: The geographical location of Bishkek near the midway point for the air routes between Europe and Southeast Asia, combined with the potential for lower priced aviation fuel from domestic resources, could make Bishkek–Manas International Airport attractive as a refueling point for long-haul air cargo flights. While fuel prices are an important consideration, fuel quality, availability of support services,

and the local traffic base are also factors that influence airline locations for stopover points. In the Central Asian region, Bishkek would be competing with Almaty and Tashkent, both of which have a larger local traffic base, established support services, and more significant domestic oil resources. Thus, it is not clear how successful Bishkek–Manas International Airport might be in attracting this traffic. While this strategy might generate some additional aircraft movements and airport revenue, it is not likely to significantly affect the national freight traffic forecasts.

2. *Foreign trade zone*: A specific strategy being considered to increase international trade is the creation of an FTZ adjacent to the airport. The objective of establishing FTZ is to attract foreign investment in manufacturing and logistics activities that can allow goods to be moved in and out for storage or processing without incurring duties. The Kyrgyz Republic is likely to face considerable competition for such activities from other republics of the CIS that may adopt the same approach. The relatively small size of the domestic economy will tend to make the Kyrgyz Republic less attractive than other potential locations. However, its geographical location on the boundary between the CIS and China to the east, and the ECO States to the south and west, may give it some other advantages.

A synergy may exist between the development of an FTZ and the development of hub activity by the Kyrgyz national airline. The availability of good air service to many points in the region of Central Asia will increase the attractiveness of the FTZ, which will generate traffic that supports the airline route network.

### 7. Airport traffic forecasts

The foregoing process yields national forecasts for enplaned passengers throughout the Kyrgyz Republic under the Baseline, Slow Growth, and Strong Recovery scenarios. Preparation of forecasts for Bishkek–Manas International Airport, and indeed other airports in the republic, is then a question of allocating or proportioning the forecast national traffic to individual markets. This of course also determines the domestic and international share at Bishkek–Manas International Airport. The proportion of the national traffic in each market given by recent historical data was adjusted to reflect expected future changes in the proportion of passengers traveling to CIS or other international destinations.

The effect of increased foreign trade would tend to increase the proportion of international traffic compared to the traffic between the Kyrgyz Republic and other republics within the CIS, although the increase in the domestic economy stimulated by trade expansion would

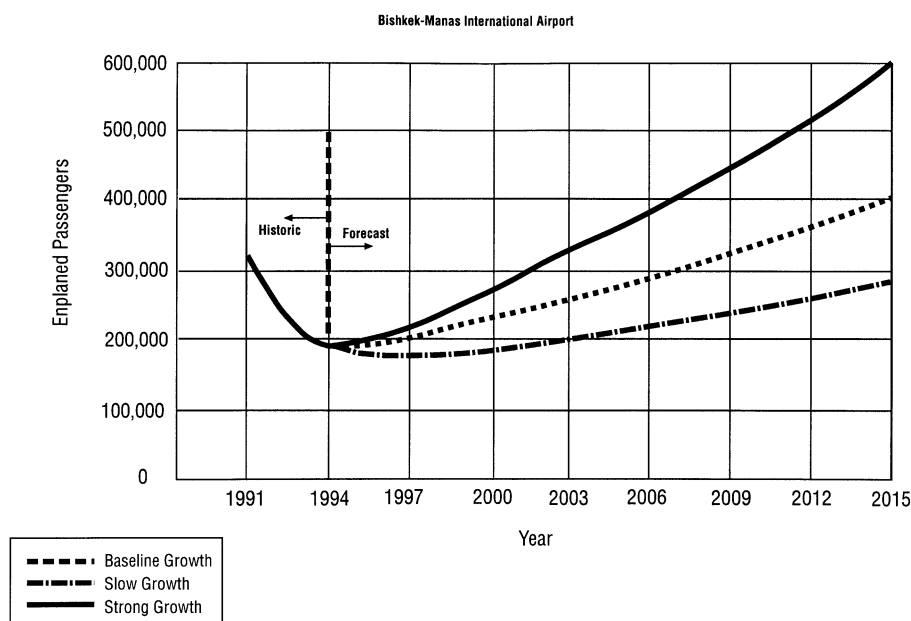


Fig. 7. Forecast of enplaned passenger traffic Bishkek–Manas International Airport.

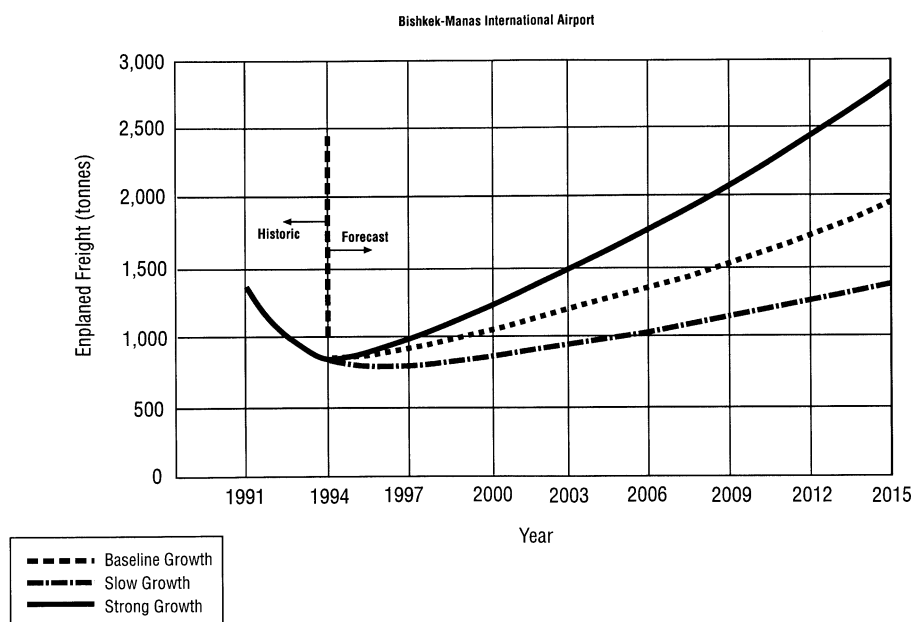


Fig. 8. Forecast of enplaned freight traffic Bishkek–Manas International Airport.

tend to offset any reduction in the actual level of traffic with the CIS. The resultant forecasts for Bishkek–Manas International Airport, using this methodology, are then presented in Figs. 7 and 8 for passenger and freight traffic, respectively.

### 7.1. Forecast performance

Since the forecast described in this paper was performed, additional data have become available on the air

traffic levels at Bishkek–Manas International Airport for the period from 1994–1996. These are shown in Table 6, together with the corresponding forecast values under the three economic growth scenarios and the changes in the underlying economic factors.

Both passengers and freight showed a stronger recovery than projected, while at the same time, the real gross domestic product declined more steeply in 1994 than was assumed in the forecasts. However, by 1995, the expected recovery appears to have begun. It should be noted that

Table 6  
Forecast performance Bishkek–Manas International Airport

	Baseline	Slow growth	Strong recovery	Actual
Enplaned passengers (000)				
1994	191.1	191.1	191.1	215.4
1995	191.1	183.7	197.4	260.1
1996	198.5	179.6	207.3	279.0
Enplaned freight (tonnes)				
1994	861	861	861	1465
1995	861	830	888	1671
1996	899	818	937	1241
GDP growth (percent)				
1994	– 5.2	– 5.2	– 5.2	– 20.1
1995	0.0	– 3.5	3.0	1.30
1996	3.0	– 2.5	4.0	n/a

Note: Sources: Actual traffic from airport statistics. GDP growth from International Monetary Fund, *World Economic Outlook*, October 1996

GDP data for transitional economies, such as the Kyrgyz Republic, are much less reliable than for stable, developed economies, such as Europe. Apart from the difficulties of obtaining timely statistics, it is unlikely that all sectors of the economy will experience the same growth rates. Thus some sectors may be growing rapidly while others are continuing to decline. Because these sectors have different needs for air transportation, the link between aggregate GDP and air traffic is likely to be erratic. This can be seen from the fact that passenger traffic continued to grow in 1996, while freight enplanements declined to a lower level than 1994. Similarly, while real GDP was reported to decline by 20% in 1994, enplaned passengers increased from 172 200 to 215 400 and enplaned freight increased from 677 to 1465 tonnes. This suggests that forecast performance could be improved with models that link air traffic volumes to economic data at a sectoral level. However, in the current study such data were not available. Even so, the use of aggregate economic data has captured the recovery from the rapid decline in air traffic prior to 1994. It remains to be seen whether the underestimation in traffic levels for 1994–1996 is just a transitional effect, or whether in the longer run there is a systematic difference between the forecasts and the actual traffic suggesting that the Kyrgyz Republic has a somewhat different relationship between GDP and air traffic than the countries used to calibrate the model.

## 8. Summary

While master planning studies for developed airports in the United States, Europe, and the Pacific Rim have a significant database of traffic information from which to draw, the situation is very different in the Kyrgyz Republic. Record keeping under the planned economy was nearly nonexistent as compared to Western practice, and the premise that the future can be predicted from an analysis of historical patterns, which is the foundation for most master planning studies, clearly is not applicable within the FSU.

The Kyrgyz Republic is going through a period of rapid change that makes it difficult to predict future economic or air transportation growth. Air travel under a market-based economy cannot be expected to produce traffic levels or travel patterns similar to those experienced under the previous subsidized system. Given the uncertainties facing the republic and the aviation sector, airport planning requires flexibility so that the airport system can easily adapt to a wide range of possible growth scenarios.

Thus, the forecasting approach adopted in this situation must give much greater attention to defining the economic conditions that can be expected under different-growth scenarios than is the case in traditional aviation forecasting studies. This is necessary both to ensure that the implications for future air traffic levels of different economic policies are understood and to be able to anticipate likely future shifts in the composition of the traffic.

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