

PRELIMINARY STUDY OF
AIR CONNECTIVITY AND COMPETITION
AIR TRANSPORT DIAGNOSTIC PROJECT
OF
INTERNATIONAL CIVIL AVIATION ORGANIZATION (ICAO)
AND
INTERDISCIPLINARY CENTER FOR MATHEMATICAL AND COMPUTATIONAL MODELLING
(ICM)

1. BACKGROUND

1.1 Airline competition has evolved from an era of economic regulation and intervention to an increasing trend towards liberalization. This in turn has resulted in the global air transport network transiting from simple networks structures with limited competition and connectivity options of the past to complex structures of today responding dynamically to the changes in regulations and the business opportunities offered by liberalization.

1.2 The global air transport network is characterized by more connectivity options to customers with a variety of competitive network strategies pursued by the major aviation stakeholders. Some of these strategies include decisions related to a) point to point versus hub and spoke systems b) yield management to respond effectively to demand through pricing and product differentiation and c) alliances and mergers. These strategies are invariably a trade-off between the most economically efficient path to transport passengers through the various nodes available in the network constrained by real time factors that prevent the network from being the most optimized or efficient.

1.3 The factors that impact the route network flow i.e. the true origin destination demand flow path on a network from the most efficient path to a sub-optimized path are –

- 1) Size of the market (existing demand) and pricing strategies of existing competitors.
- 2) Policy factors –air carrier ownership and control, liberalization and regulation of traffic rights to fly (market access), cross ownerships of aviation verticals, taxation and charging policies.
- 3) Slot availability and other restrictions like lack of infrastructure, night and noise curfews.
- 4) Presence of alternative models on a route i.e. low cost carriers versus legacy carriers

2. AIR TRANSPORT DIAGNOSTICS PROJECT

2.1 ICAO and the Interdisciplinary Centre for Mathematical and Computational Modelling (ICM) of the University of Warsaw have initiated a joint air transport diagnostics project. The project aims to better understand the complex dynamics and interlinkages between the various policy factors and market realities that influence the competitive strategies of the aviation stakeholders and the optimization of the global air transport network.

2.2 This project does not aim at facilitating optimization of the air transport network through static network models. The Project rather considers the existing market realities in its mathematical optimization models. The models can theoretically as well as empirically explain and relate current and forecasted demand on a route to evolving policies, competitive strategies, increasing connectivity and the optimization of the global air transport network.

3. DECISION SUPPORT SYSTEMS FOR INFORMED POLICY MAKING

3.1 Over the next triennium the results of the project will be made available as a visual interactive decision support system (DSS) to ICAO Member States and other stakeholders. The system will indicate areas where the market forces provide potential opportunities to States to further increase connectivity and optimization of the air transport network through appropriate policy initiatives and addressal of constraining factors.

3.2 The application leverages nearly four decades of ICAO data in its Enterprise Wide Data Management (EDM) repository supplemented with external data sources. The Big Data so available is being processed by ICAO and ICM using contemporary ICT applications and sophisticated statistical models. The DSS will be a single platform where States have the information to better gauge the valuation of their granting of traffic rights to fly and the opportunity costs associated with their policy initiatives.

4. RESULTS OF THE PRELIMINARY ANALYSIS

4.1 ICAO and ICM have initially analysed as a prerequisite for this project, the two major existing factors namely demand and price that influence competitive strategies of the aviation stakeholders and the optimization of the global air transport network.

4.2 The analysis that covers of millions of data sets and data points is too detailed to be provided in this reference document. A segment of the preliminary analysis based on most recently available international trips data for the year 2015 is presented in the Appendix and includes the following

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- 1) Global passenger flows to true origin-destination going direct and indirect (via connecting nodes).
- 2) Direct and indirect passenger flows by region of departure and by route groups.
- 3) Direct and indirect connectivity ratios for route group pairs along with average fare in US dollars. The fare used is average of discount economy fare and excludes taxes and charges not retained by the air carrier.

The direct and indirect connectivity for the purposes of this analysis includes domestic legs as part of an international trip. The exclusions of domestic legs in an international trip significantly changes the composition of direct and indirect traffic average fares.

ICAO will be making available the DSS to States and major stakeholders soon where each of the above elements can be further customized by them to meet their specific requirements for data driven policy making.

4.3 The results of the preliminary analysis encompassing the entire big data set leads to the following overarching observations–

- 1) With the inclusion of domestic legs on international trips 69% of the passengers in 2015 flew direct to their destination and 31% flew through connecting nodes in the air

transport network. Around half of indirect passengers include domestic connections on the international trip.

- 2) There exists differences in the direct and indirect connectivity at the country pair level which when summarized is reflected at the region pair or route group pair level.
- 3) Inclusion of domestic legs on the international trip results in higher average indirect fares compared to average direct fares.

4.4

The preliminary conclusions from these observations are –

- 1) Market forces primarily the presence of demand or otherwise on a route determines the competitive strategies and economic efficiencies of providing direct or indirect routes in the global air transport network.
- 2) Poor Demand translates to poor connectivity and optimization is achieved through indirect flights. Lack of policy initiatives in many cases act as a constraint in achieving an optimized indirect route flow network.
- 3) Fare levels are deeply influenced by the competition between carriers on a route. Average direct fares appear to have a premium over indirect fares on long haul routes. On the rest of the routes, the spread between average direct and indirect fares reflects a degree of competitive advantage of hubs on routes in the air transport network.
- 4) Significant demand on some long haul routes and forecasted strong growth rates along with new aircraft technologies has resulted in traditional hubs that have been existing over several decades competing with more recent hubs leading to increasing connectivity and more nodes being introduced in the air transport network.
- 5) Demand exists on some high density long haul routes that could make it more efficient for air carriers to fly direct routes or integrate it with their existing network or alliances. A trend in this direction could suggest the potential of further optimizing the global air transport network impacting infrastructure development in the different regions as well as capacity available through traditional and new hubs.

APPENDIX A

Figure 1 - Global International Passenger Flow

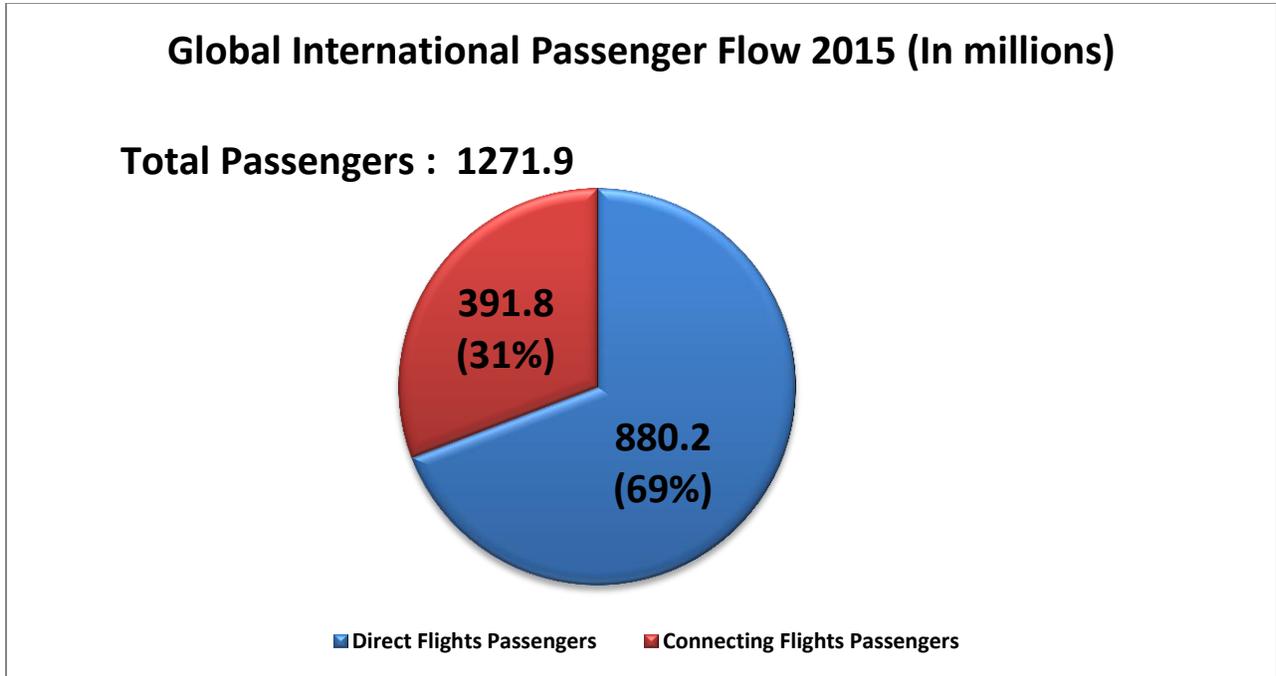


Figure 2 – Regional International Passenger Flow

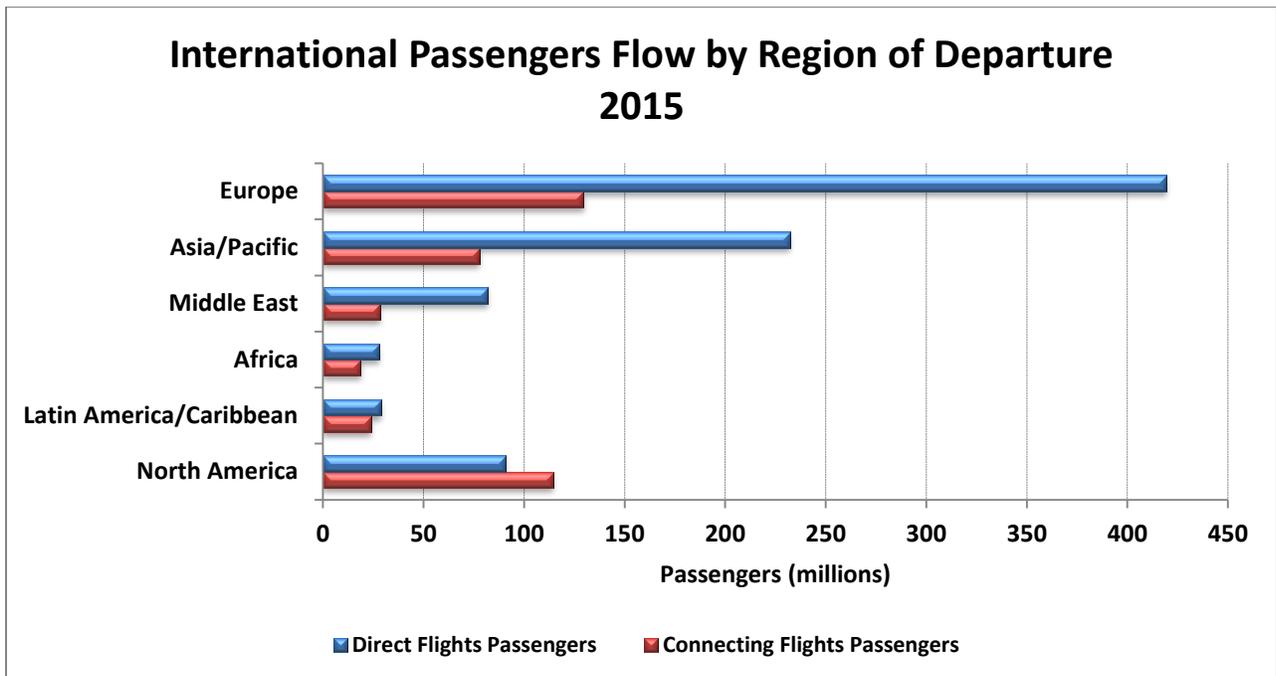


Figure 3 - Asia/Pacific International Passenger Flow

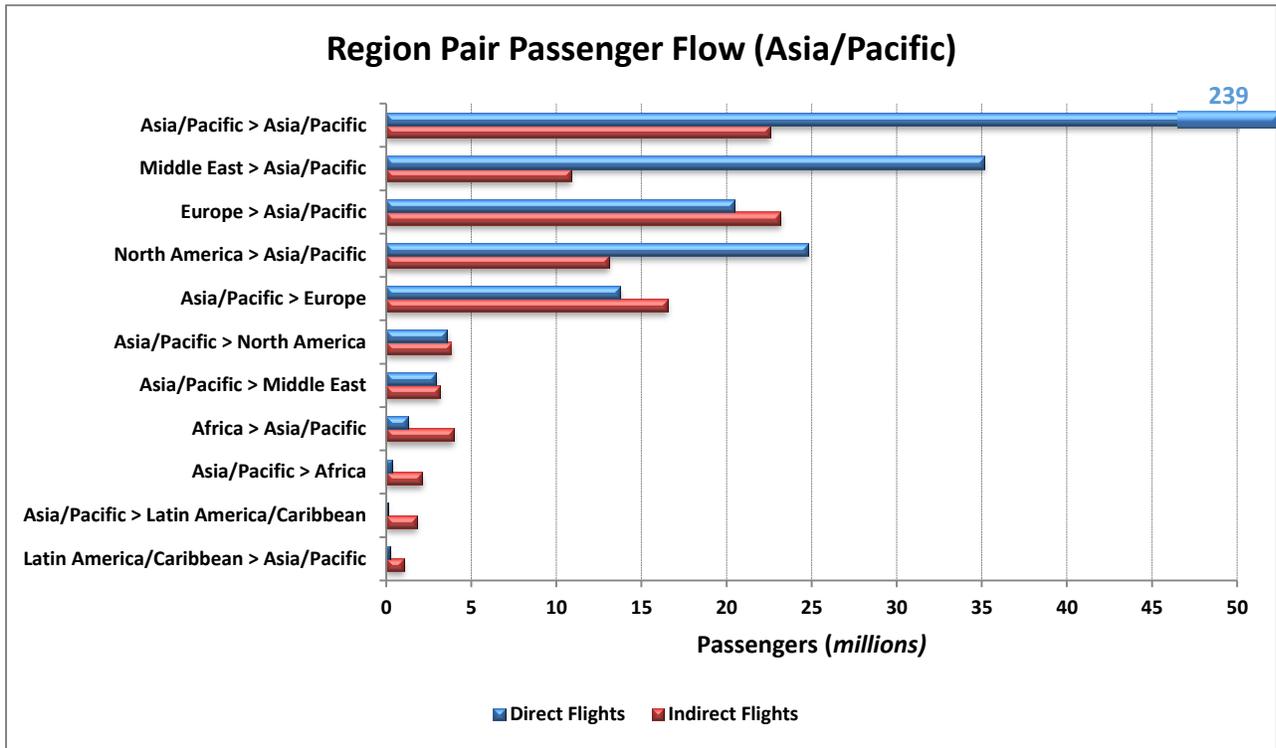


Figure 4 - Africa International Passenger Flow

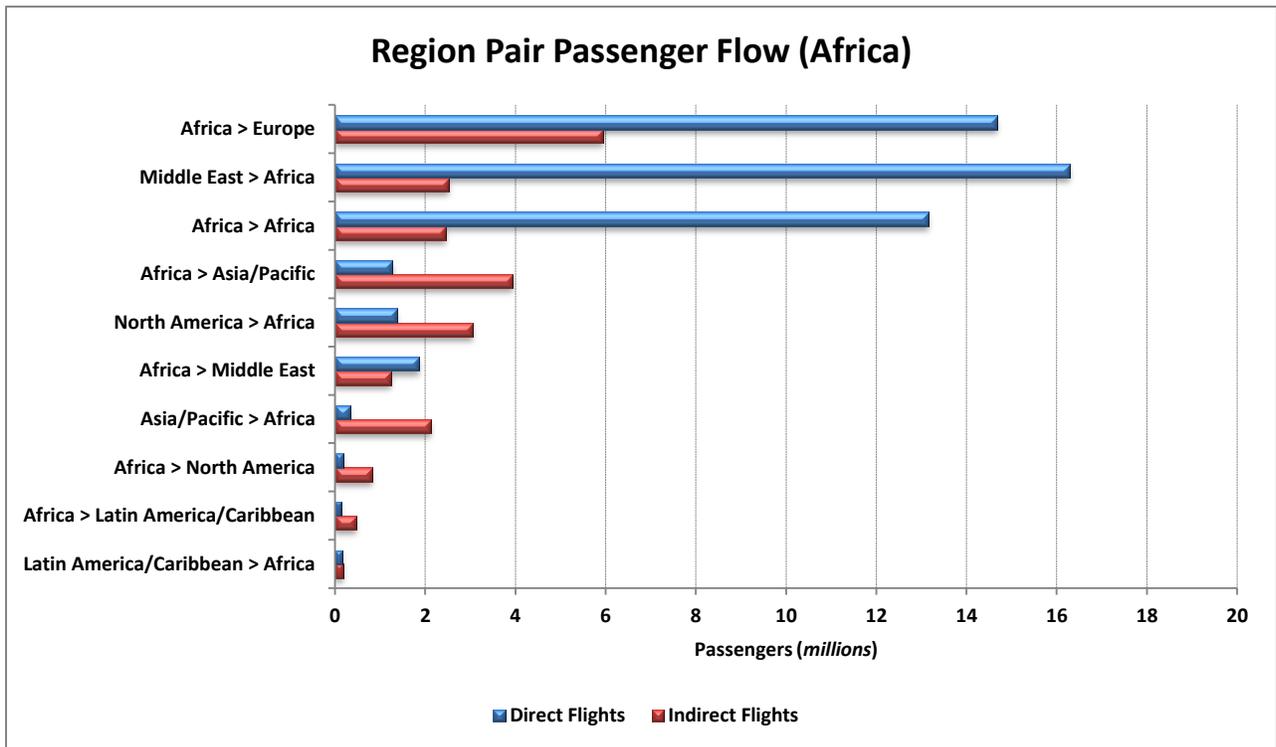


Figure 5 - Europe International Passenger Flow

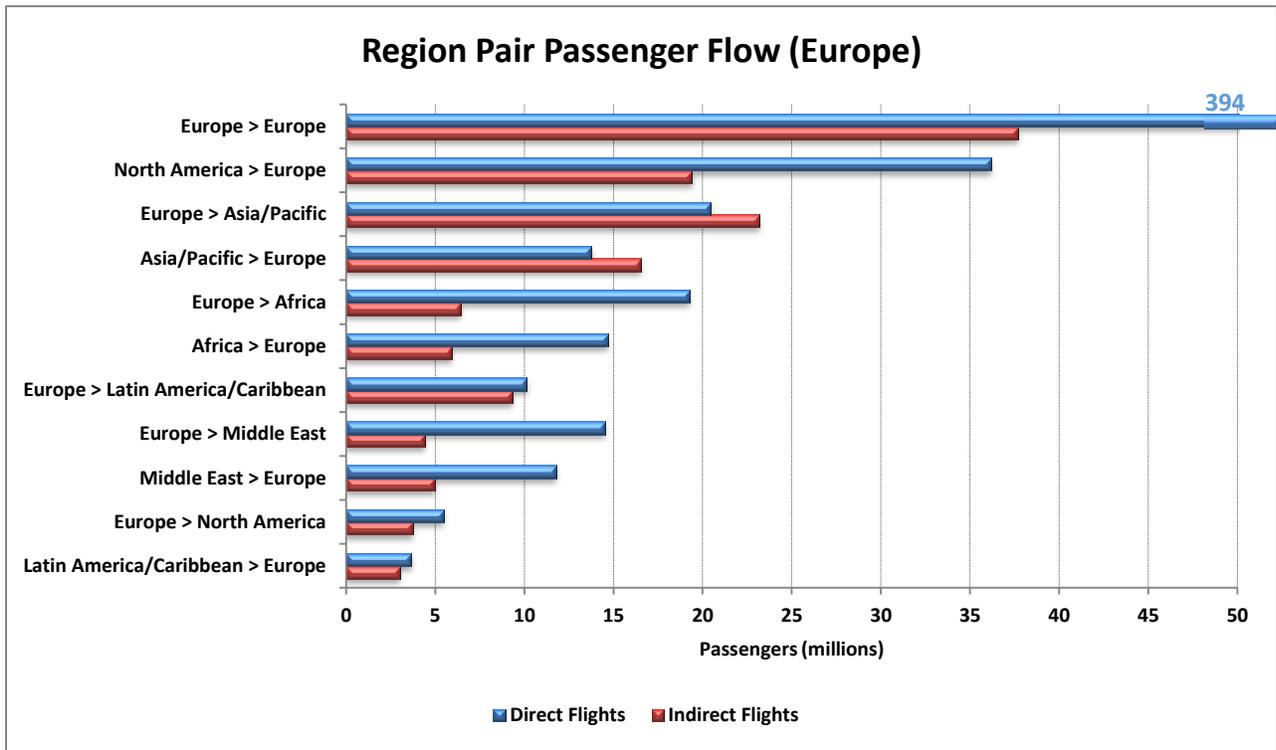


Figure 6 - Middle East International Passenger Flow

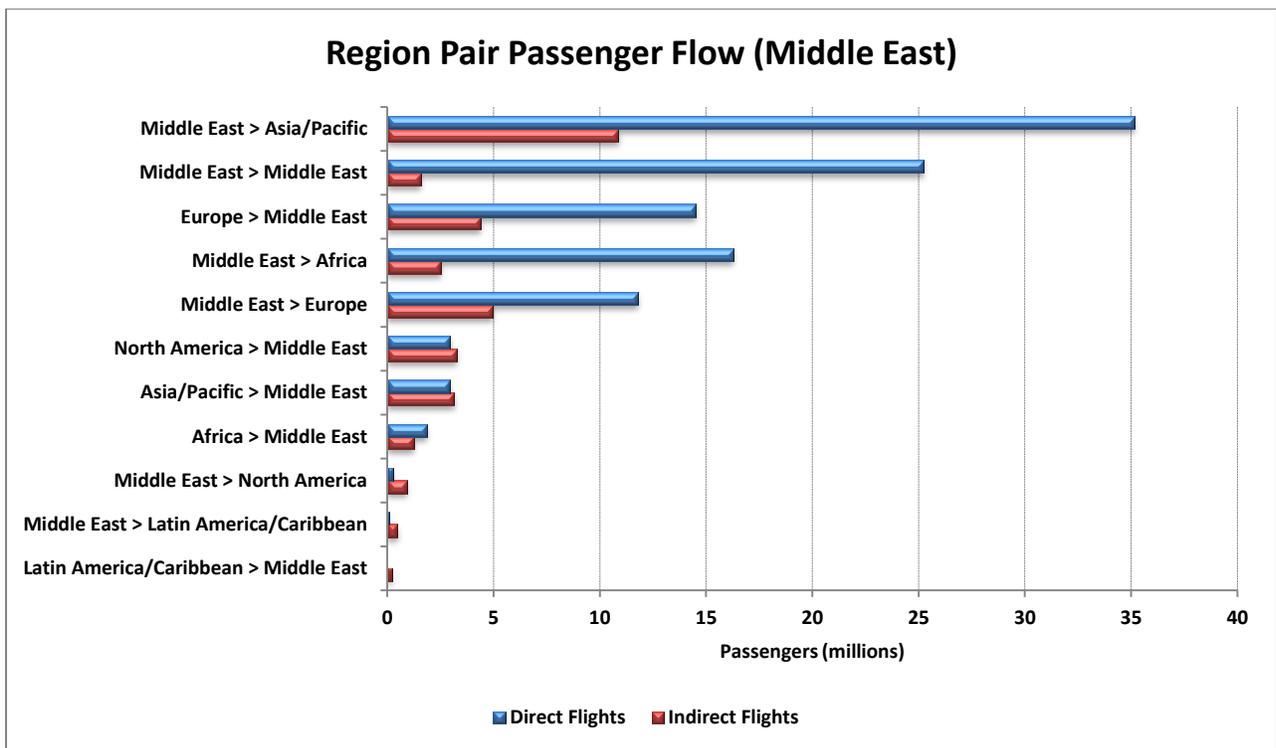


Figure 7 - Latin America/Caribbean International Passenger Flow

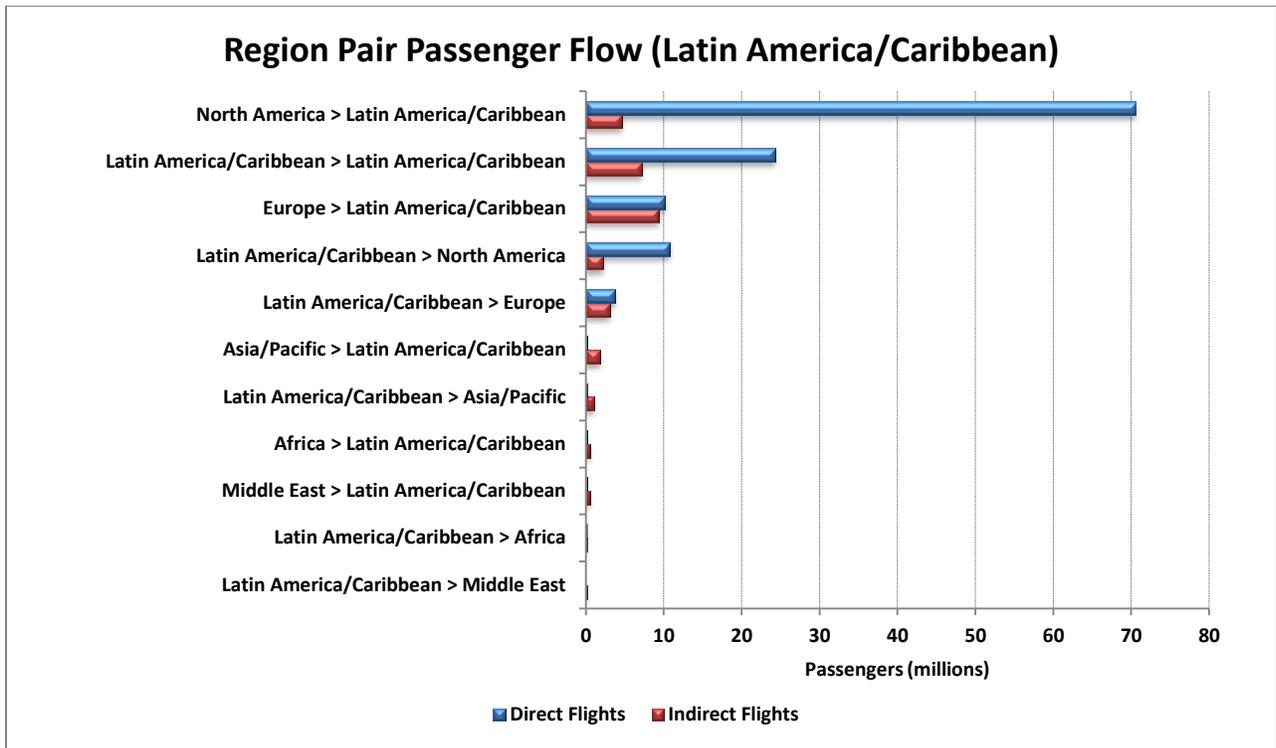


Figure 8 - North America International Passenger Flow

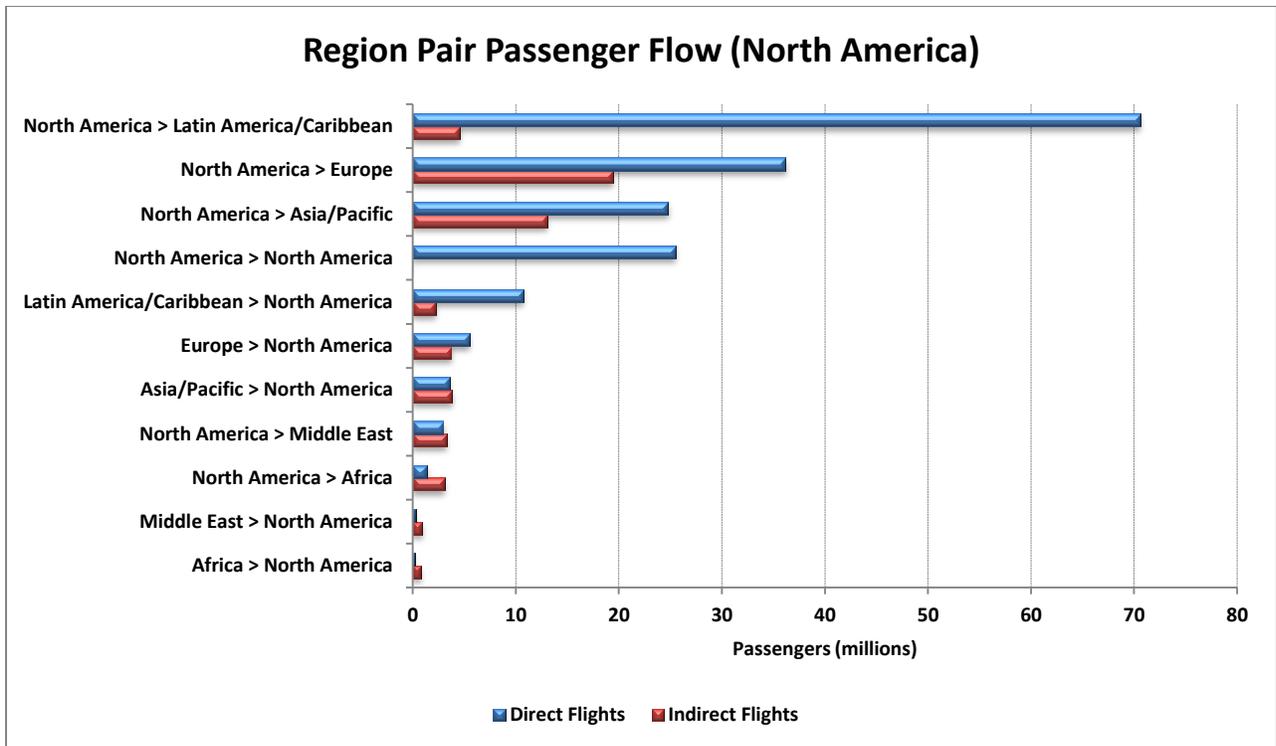


Figure 9 - Route Group International Passenger Flow

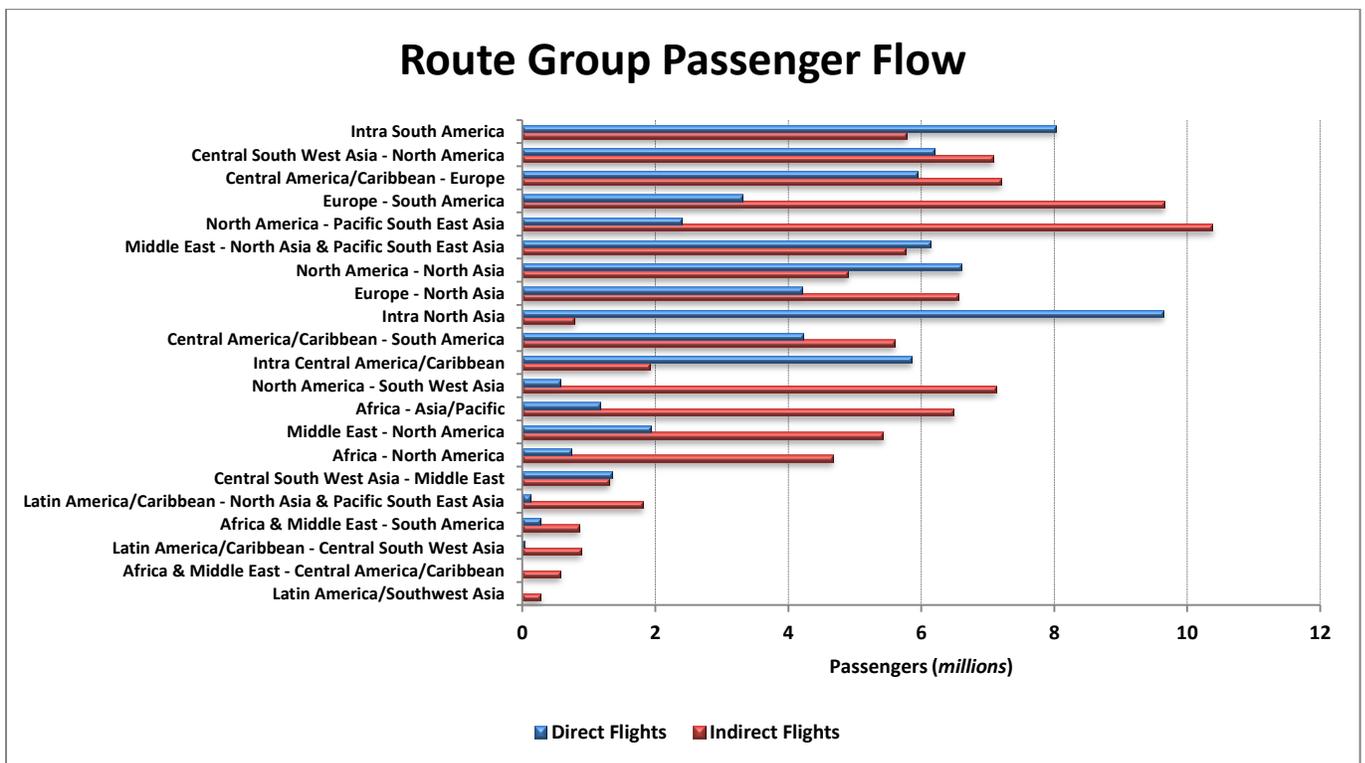
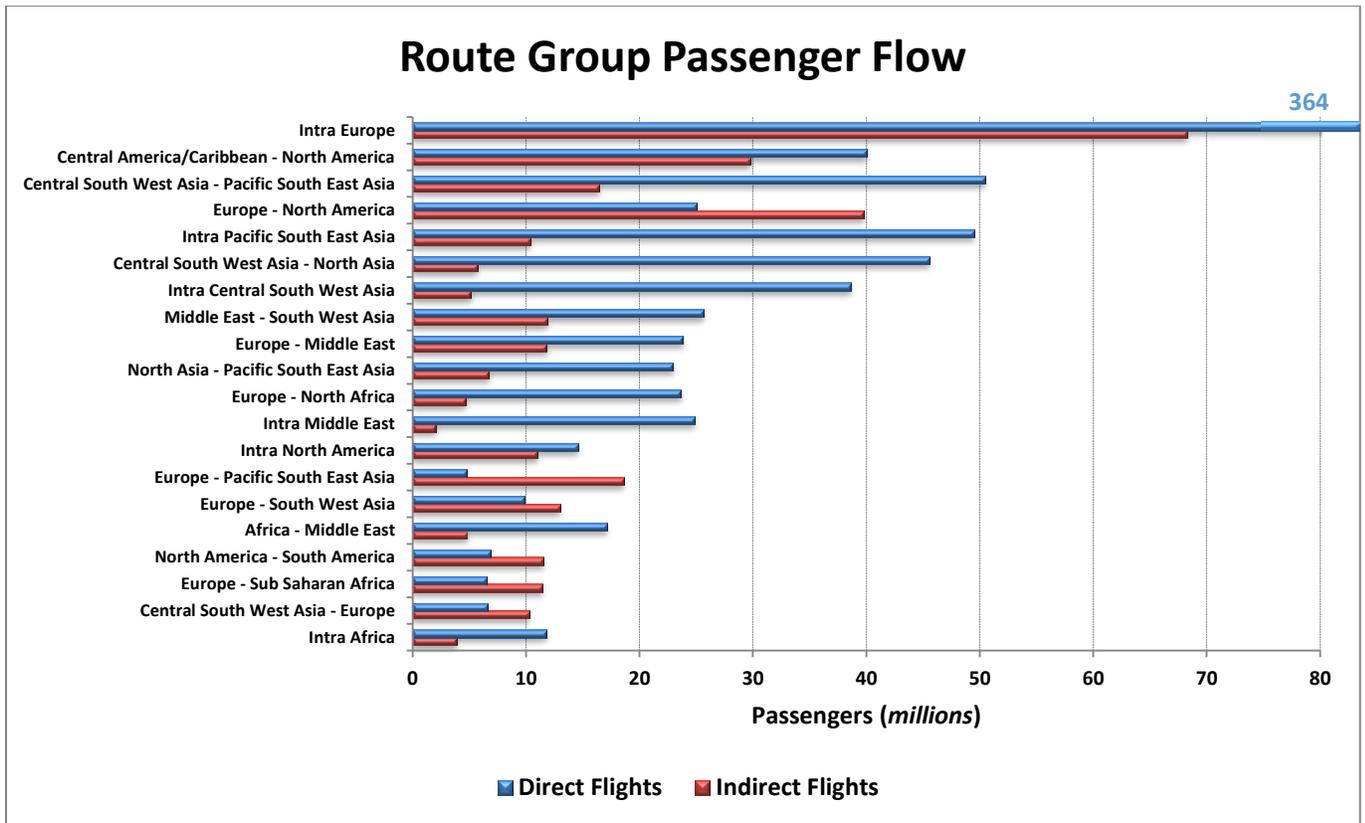


Figure 10a - Route Group Connectivity and Average Fares (Inclusive of Domestic Connections in International Trips)

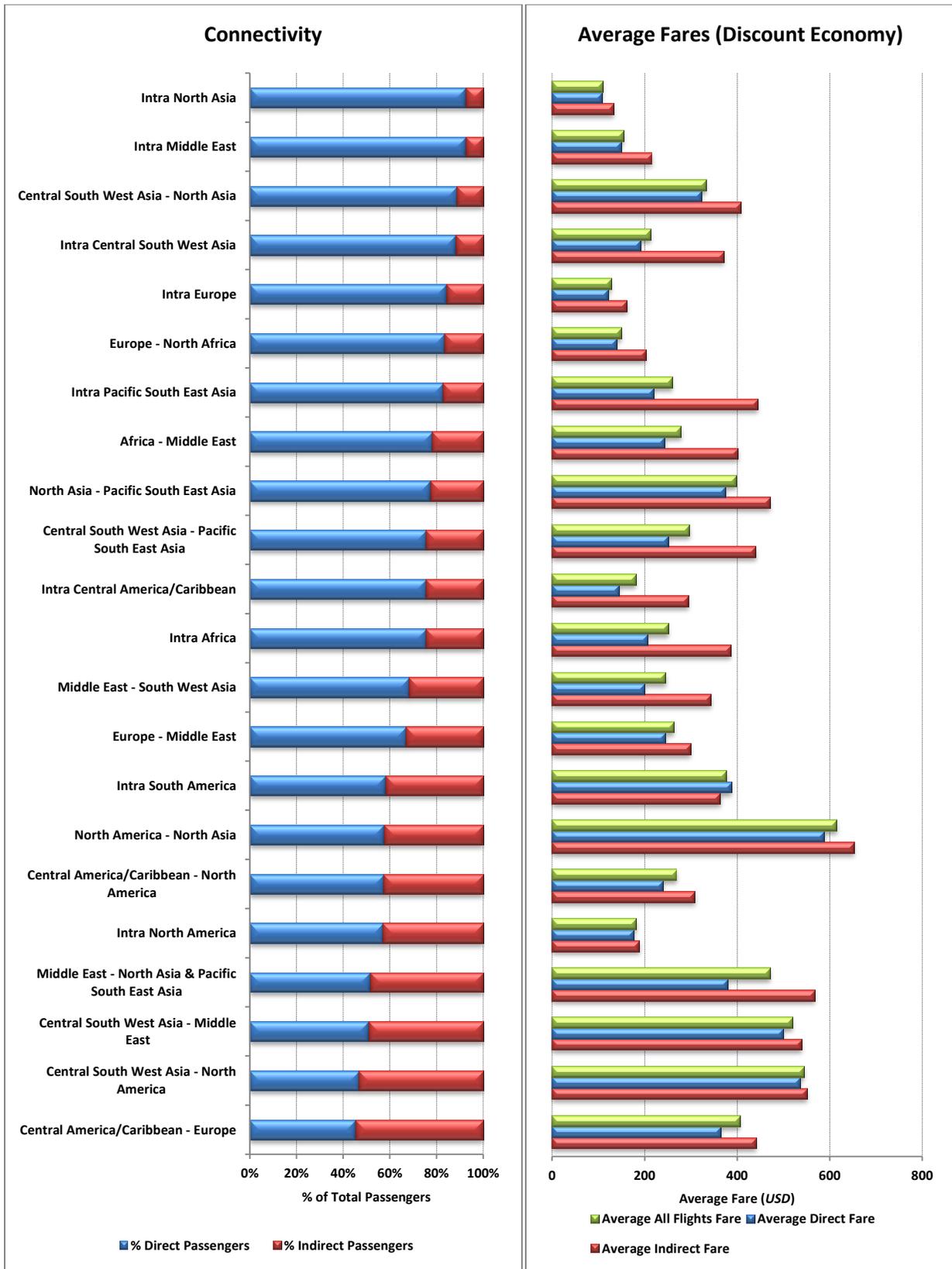


Figure 10b - Route Group Connectivity and Average Fares (Inclusive of Domestic Connections in International Trips)

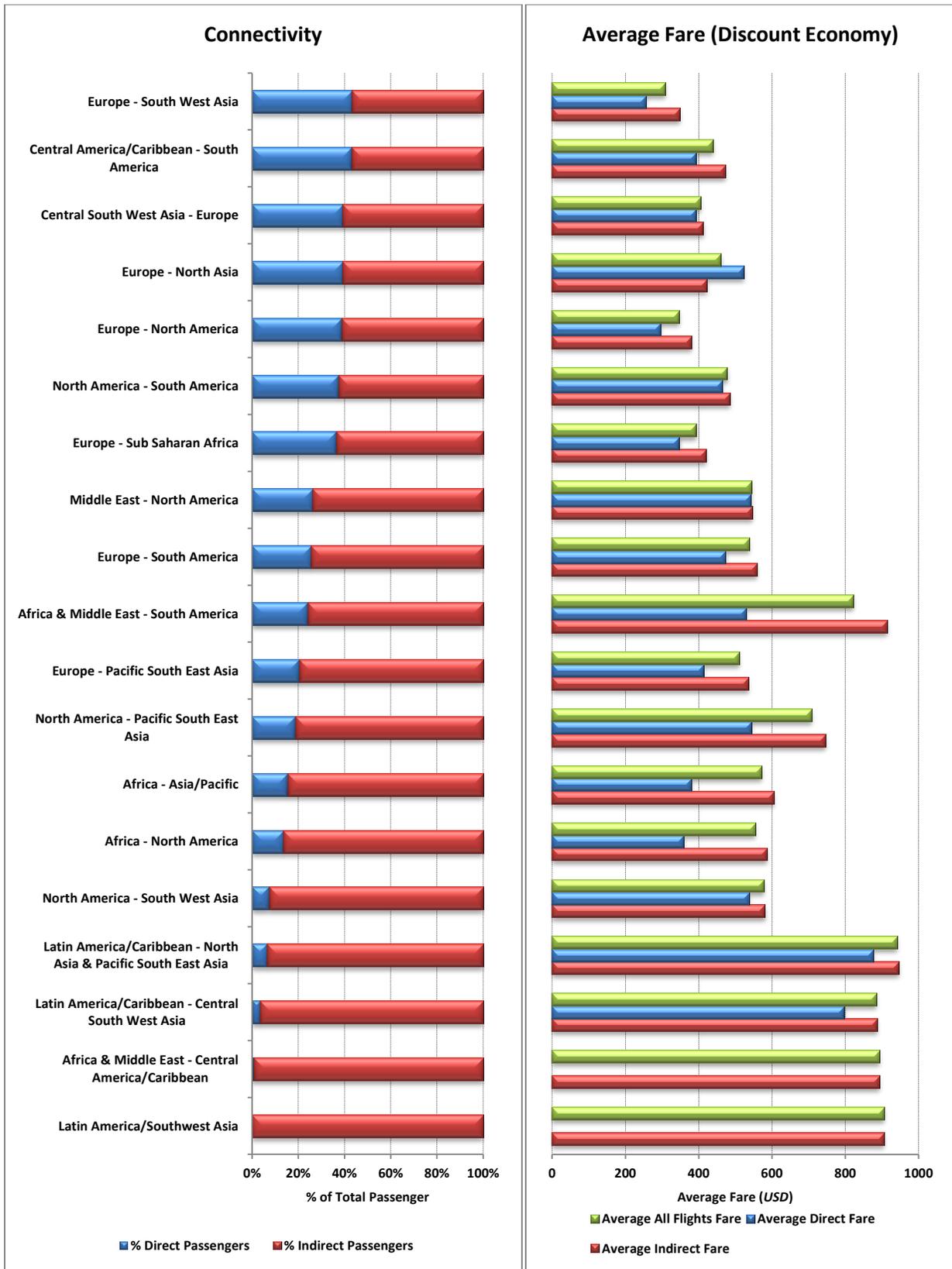


Figure 11a - Route Group Connectivity and Average Fares (Exclusive of Domestic Connections in International Trips)

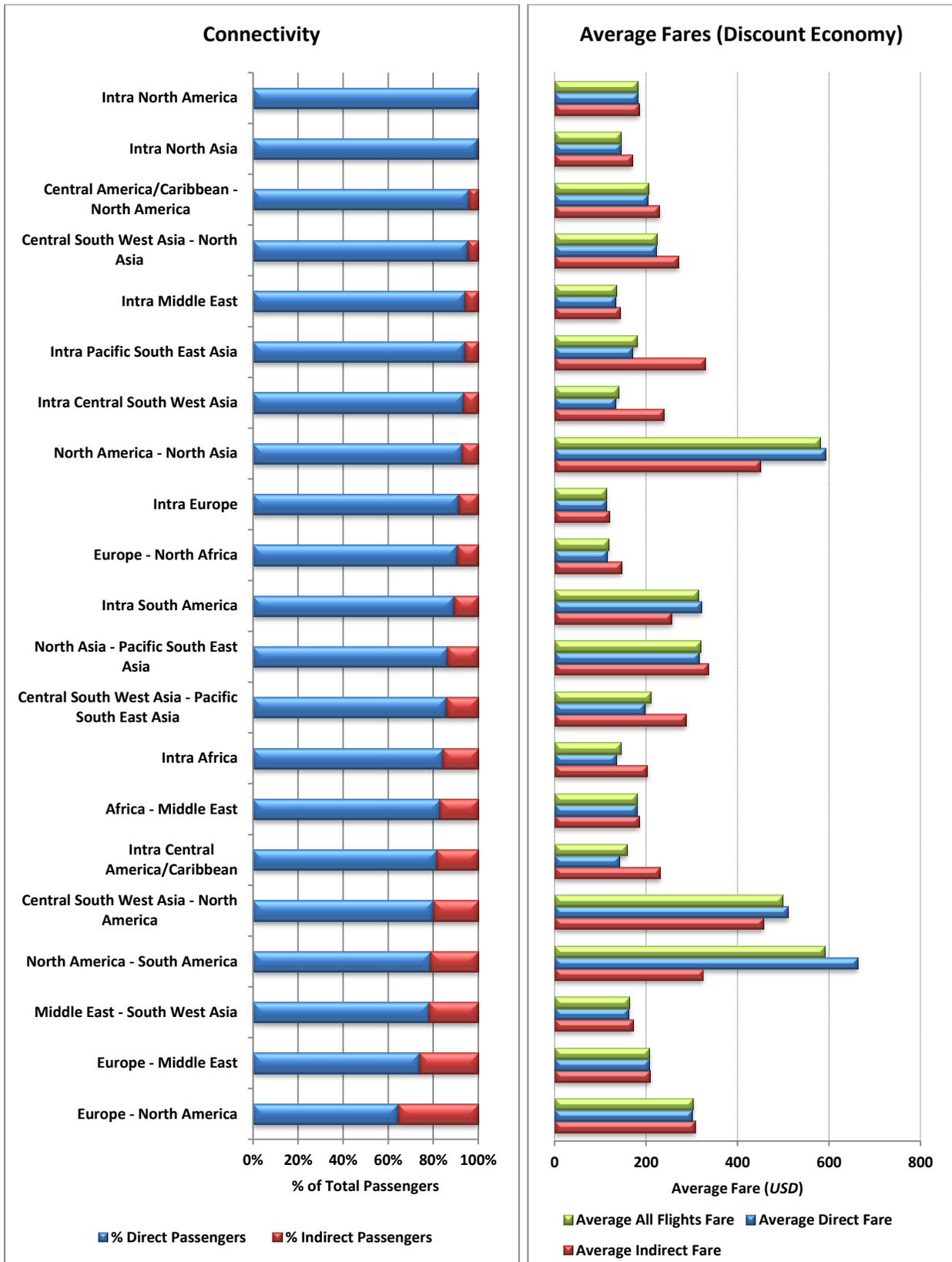


Figure 11b - Route Group Connectivity and Average Fares (Exclusive of Domestic Connections in International Trips)

