Towards A Competitive Air Transport Market in Africa:

The Role of Bilateral Air Service Agreements Liberalization

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Introduction

- Air transport services are essential for countries' economic growth and development
  - travel is crucial for market access and global integration
  - international trade and FDI depend on air transport
  - technology transfers and knowledge diffusion increase with spatial mobility
- Air transport network can grow and connect regions at a faster pace than other modes of transport
  - Compared to building continental highway or railway systems

Air Transport Markets in Africa

In Africa:

- Air transport services **lag behind** compared to rest of world
  - 2-3% of the global air passenger market
  - 17% of the world's population
  - 7.2% of the world's middle class

(Source: African Development Bank Group, 2019)

Air Transport Markets in Africa

In Africa:

- Air transport services **lag behind** compared to rest of world
  - 2-3% of the global air passenger market
  - 17% of the world's population
  - 7.2% of the world's middle class

  (Source: African Development Bank Group, 2019)

- Why the slow growth of air transport services?
  - restrictive international aviation regulation
  - burdensome domestic air regulations
  - domestic political envioronment + weak institutions
  - other factors (e.g., financial frictions, geography, etc.)

Air Transport Markets in Africa

This study:

- Analyze empirically the impact of international regulation on air transport services in Africa
- Focus on the market transformations brought by policy liberalization

This Paper

Research Questions:

1. Contribution of *Bilateral Air Service Agreements (BASAs)* to the growth and development of air passenger transport within Africa

2. Does the *liberalization* of BASAs affect African consumers by generating sizable *welfare gains*?

This Paper

Methodological approach:

- Identify the market mechanisms through which BASA liberalization affects air transport markets
- Propose econometric models to estimate the effect of BASA liberalization on:
  - passenger flows
  - average air fare
  - flight frequency
  - market competition (i.e., number of airlines)
- Use estimated coefficients to construct back of the envelope welfare calculations

Preview of Results

- BASA liberalization lowers average air fares
  $\rightarrow$ **16% fall in air fares** (direct effect)
- Passenger volumes increase as a result of liberalization-induced price changes
  $\rightarrow$ **30% increase in air passengers** (indirect effect)
- No significant direct effect of liberalization on flight frequency
  $\rightarrow$ **28% increase in departures** from liberalization-induced passenger growth (indirect effect)
- No significant effect of liberalization on market competition

Preview of Results

Cumulative effects of BASA liberalization:

- Combining all the direct & indirect effects into one statistic:
  $\rightarrow$ **benefits equivalent to a 50% drop in air fares**

- Consumer welfare gains:
  $\rightarrow$ range between **290-ml and 513-ml US$** for year 2019

Roadmap

1. Policy Background
2. Data sample + descriptives
3. Estimation methodology
4. Regression results
5. Consumer welfare effects of BASA liberalization

Bilateral Air Service Agreements (BASAs)

- Global aviation markets are governed by bilateral air service agreements (BASAs)
  - multilateral agreements are harder to negotiate and implement
  - bilateral agreements serve as incremental steps towards market openness
- A typical BASA signed between two countries regulates:
  - **market access** $\rightarrow$ point-to-point aviation routes
  - **capacity** $\rightarrow$ frequency of flights per route
  - **market competition** $\rightarrow$ designated airlines to operate service
  - **pricing** $\rightarrow$ e.g., double disapproval of air fares
  - **traffic rights** $\rightarrow$ e.g., 5th freedom = pick/drop traffic on-route

Bilateral Air Service Agreements (BASAs)

- Liberalization of BASAs = removal of market restrictions

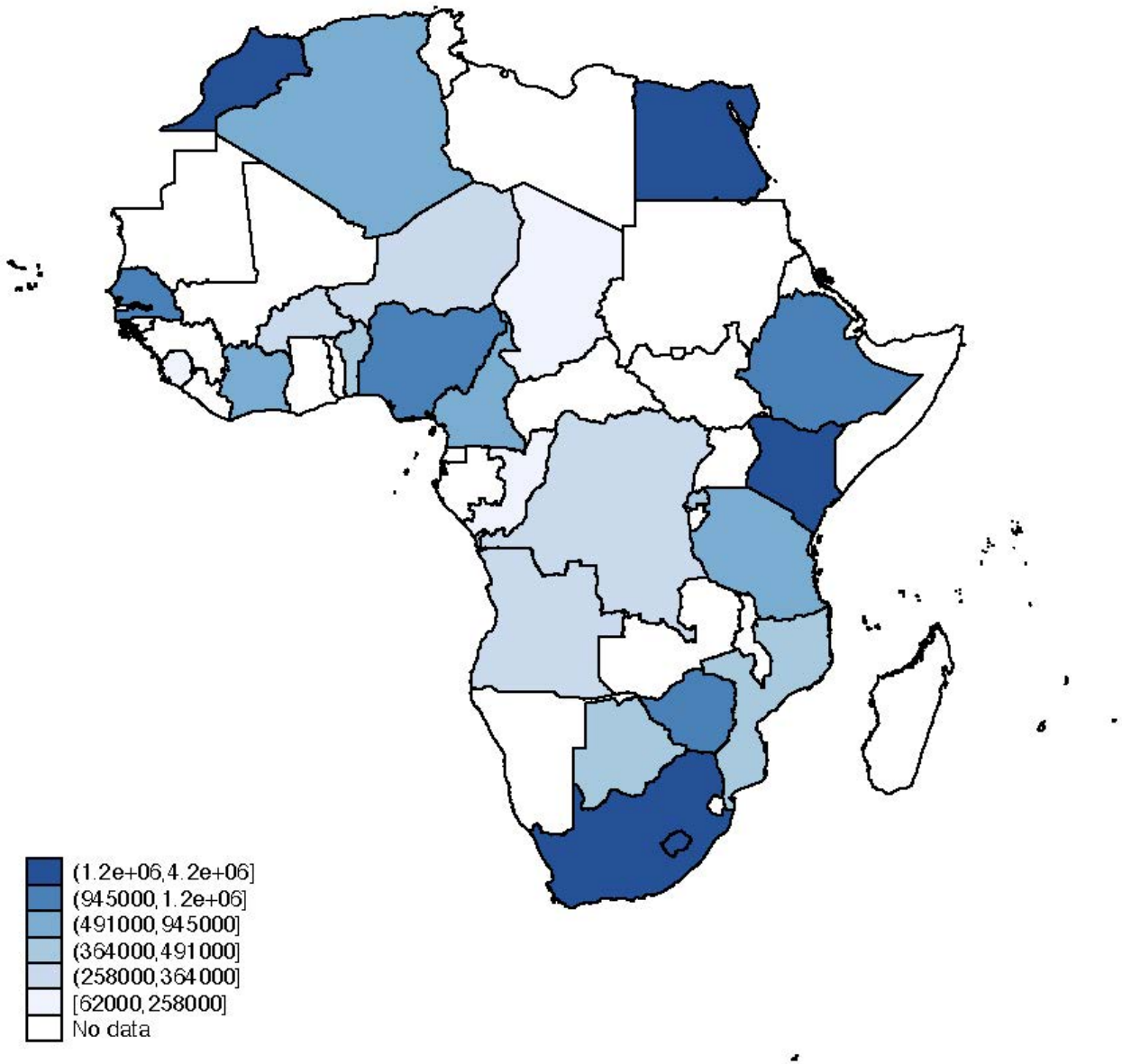
Define two indicator variables:

- **Partial liberalization** = full deregulation of ONE key set of provisions (e.g., capacity, pricing, fifth freedom)
- **Full liberalization =** full deregulation in TWO OR MORE sets of provisions

Data Sample

- **Sample coverage:**
  - 71 country pairs within Africa
  - period: 2011-2019
  - unbalanced panel → between 55-59 pairs observed per year
- **Air transport data** → bi-directional by country pair, year:
  - volume of passengers → Sable Intelligence
  - average air fare → Sable Intelligence
  - number of departures (flight frequency) → OAG database
  - number of destinations (domestic + foreign) → OAG database
  - BASA status → World Bank surveys of aeronautical authorities
  - other aviation indicators → IATA reports
- **Other country level data** → WDI, CEPII, COMTRADE

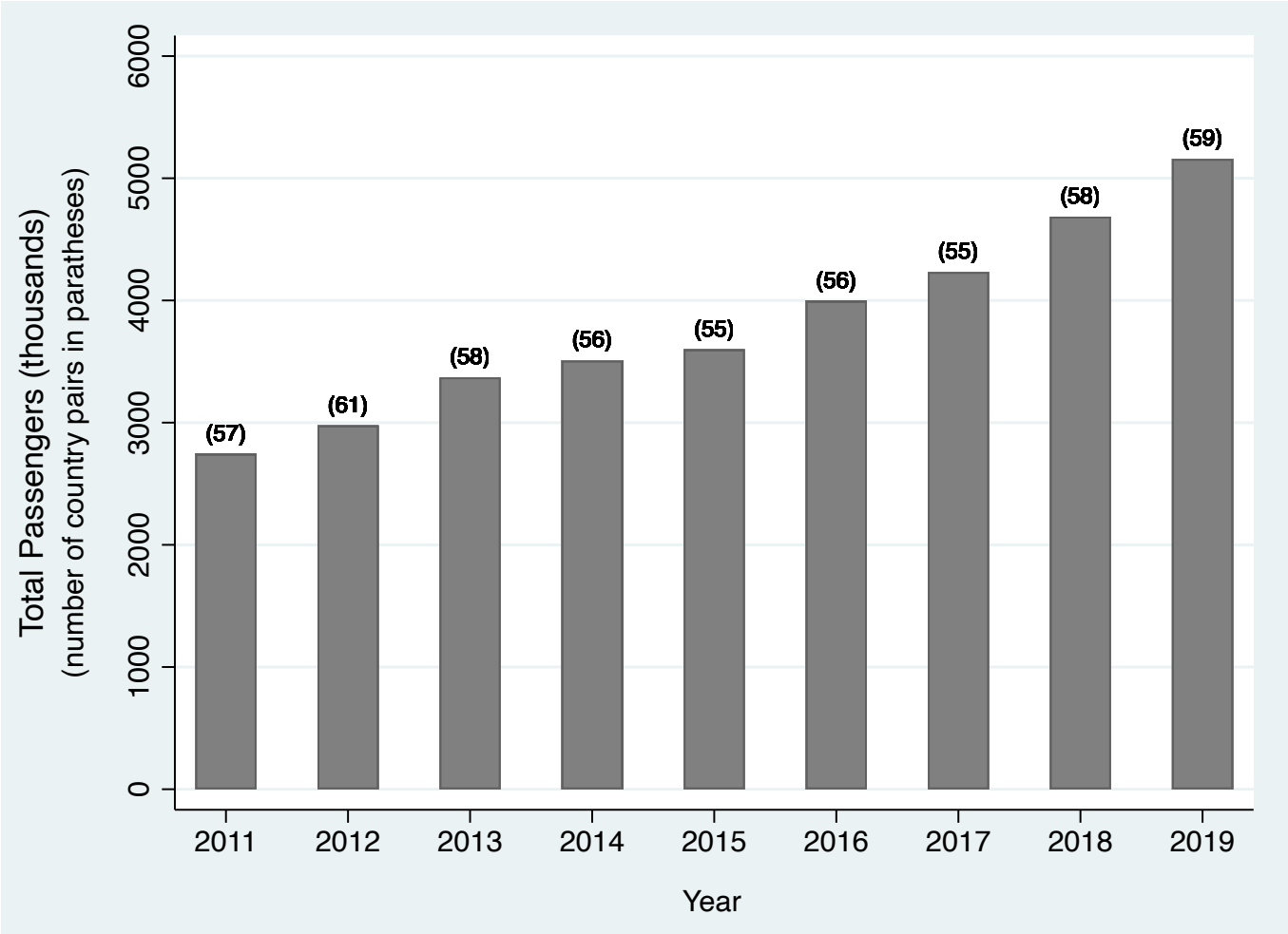
Sample Coverage: Intra-Africa Air Travel in 2019



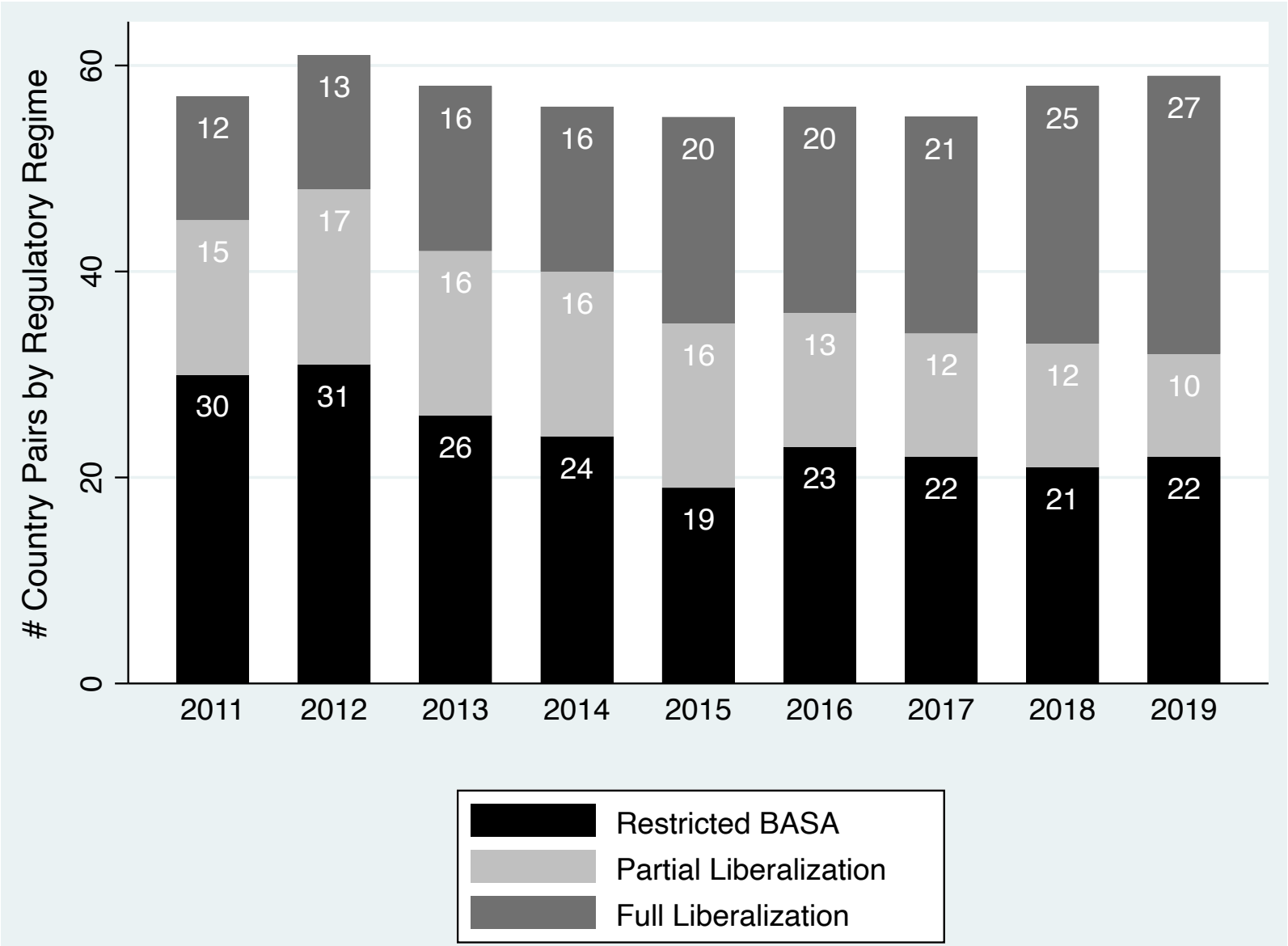
Top 10 countries:

1. South Africa
2. Kenya
3. Morocco
4. Egypt
5. Ethiopia
6. Nigeria
7. Zimbabwe
8. Senegal
9. Tanzania
10 Cote d'Ivoire

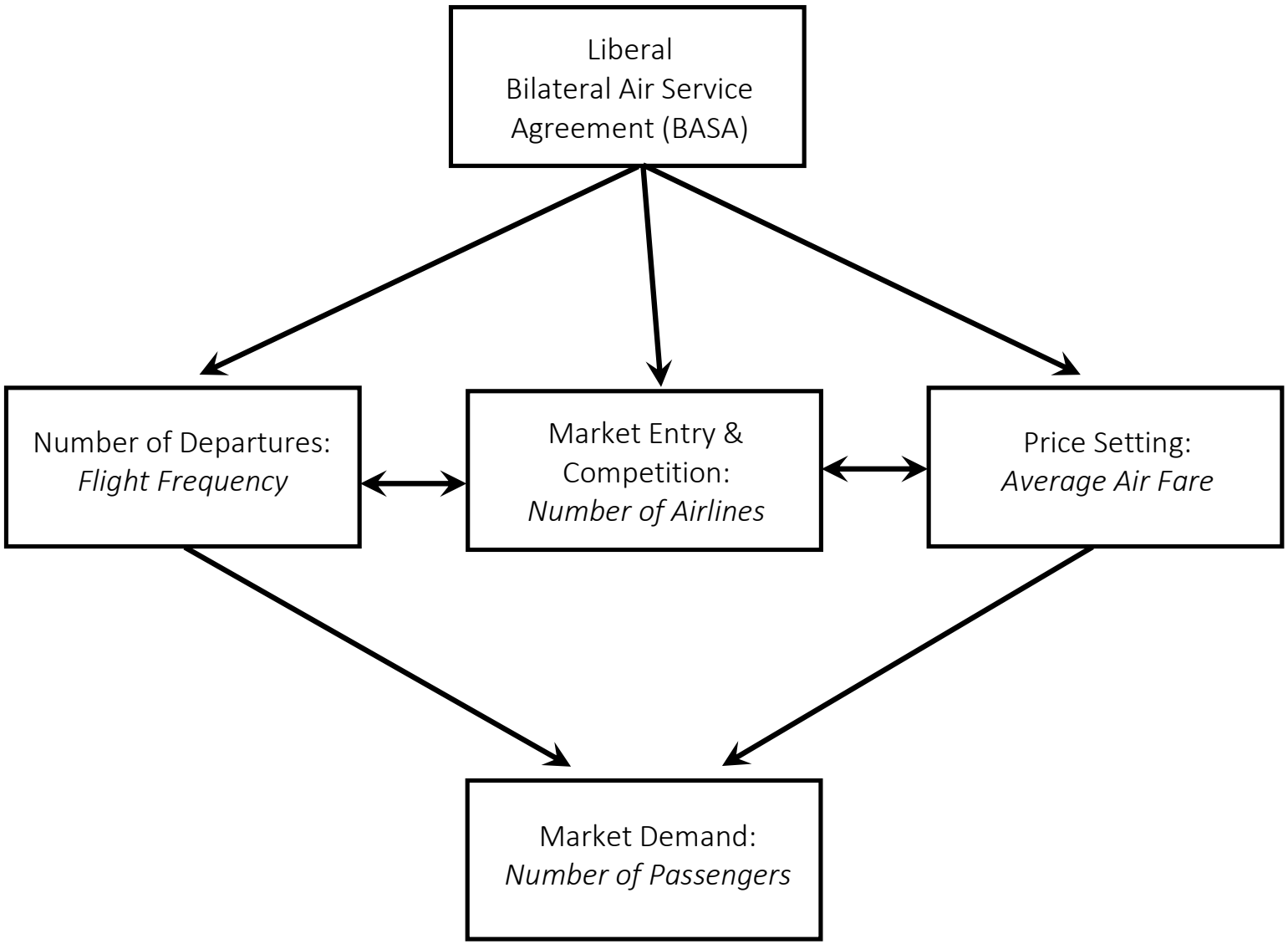
Traffic Growth Over the Sample Period



BASA Liberalization in our Data Sample



Impact of BASA Liberalization



Estimation Methodology

Notation: i, j = signatory countries t = year (2011–2019)

1. Passenger regression:

$$lnPax_{ijt} = \alpha_1 lnFare_{ijt} + \alpha_2 lnFreq_{ijt} + X_{it} + X_{jt} + X_{ijt} + c_i + c_j + u_t + \epsilon_{ijt}$$

2. Air fare regression:

$$lnFare_{ijt} = \beta_1 lnPax_{ijt} + \beta_2 PartLib_{ijt} + \beta_3 FullLib_{ijt} + \beta_4 lnNoAirlines_{ijt} + \\ + Z_{it} + Z_{jt} + Z_{ijt} + c_i + c_j + u_t + \epsilon_{ijt}$$

3. Flight frequency regression:

$$lnFreq_{ijt} = \gamma_1 lnPax_{ijt} + \gamma_2 PartLib_{ijt} + \gamma_3 FullLib_{ijt} + \gamma_4 lnNoAirlines_{ijt} + \\ + V_{it} + V_{jt} + V_{ijt} + c_i + c_j + u_t + \epsilon_{ijt}$$

4. Market competition regression:

$$lnNoAirlines_{ijt} = \delta_1 PartLib_{ijt} + \delta_2 FullLib_{ijt} + W_{it} + W_{jt} + W_{ijt} + c_i + c_j + u_t + \epsilon_{ijt}$$

Estimation Methodology

Estimation challenges:

- **Endogeneity**

  $\rightarrow$ key variables on both left and right side of regression eq.

  $\rightarrow$ *solution:* instrumental variables (2SLS) methodology

- **Simultaneity and Omitted Variable Bias**

  $\rightarrow$ countries that liberalize BASAs do other "good" things

  $\rightarrow$ *solution:* regression controls + country & time fixed effects

Passenger Regression

- Passenger regression:

$$lnPax_{ijt} = \alpha_1 lnFare_{ijt} + \alpha_2 lnFreq_{ijt} + X_{it} + X_{jt} + X_{ijt} + c_i + c_j + u_t + \epsilon_{ijt}$$

- Control variables:
  - $X_{it}, X_{jt} = \{$Per-capita GDP, Population, Urban density$\}$
  - $X_{ijt} = \{$Traded value, Distance, Contiguity, Common language$\}$

- Excluded instruments:
  - $Fare_{ijt} \rightarrow$ cost shifters $=\{$fuel cost, avg. airplane size, # airlines$\}$
  - $Freq_{ijt} \rightarrow$ air network $=\{$# destinations, avg. plane size, # airlines$\}$

Air Fare Regression

- Air fare regression:

$$lnFare_{ijt} = \beta_1 lnPax_{ijt} + \beta_2 PartLib_{ijt} + \beta_3 FullLib_{ijt} + \beta_4 lnNoAirlines_{ijt} + \\ + Z_{it} + Z_{jt} + Z_{ijt} + c_i + c_j + u_t + \epsilon_{ijt}$$

- Control variables:
  - $Z_{it}, Z_{jt} = \{$Per-capita GDP$\}$
  - $Z_{ijt} = \{$Distance, Fuel cost, Airplane size$\}$

- Excluded instruments:
  - $Pax_{ijt} \rightarrow$ demand shifters $=\{$Population, Urban density, Common language$\}$

Flight Frequency Regression

- Flight frequency regression:

$$lnFreq_{ijt} = \gamma_1 lnPax_{ijt} + \gamma_2 PartLib_{ijt} + \gamma_3 FullLib_{ijt} + \gamma_4 lnNoAirlines_{ijt} + \\ + V_{it} + V_{jt} + V_{ijt} + c_i + c_j + u_t + \epsilon_{ijt}$$

- Control variables:
  - $V_{it}, V_{jt} = \{\text{Total \# destinations per country}\}$
  - $V_{ijt} = \{\text{Distance, Airplane size}\}$

- Excluded instruments:
  - $Pax_{ijt} \rightarrow$ demand shifters $=\{$Population, Urban density, Common language$\}$

Market Competition Regression

- Market competition regression:

$$lnNoAirlines_{ijt} = \delta_1 PartLib_{ijt} + \delta_2 FullLib_{ijt} + W_{it} + W_{jt} + W_{ijt} + c_i + c_j + u_t + \epsilon_{ijt}$$

- Control variables:
  - $W_{it}, W_{jt} = \{\text{GDP} = \text{Pop} \times \text{PcGDP}, \text{ Total \#destinations per country}\}$
  - $W_{ijt} = \{\text{Distance, Traded value}\}$
- No endogenous variables

Passenger Regression

	(1) OLS	(2) OLS	(3) 2SLS
Ln Avg Airfare	-0.574***	-0.468***	-1.390***
	[0.157]	[0.108]	[0.513]
Ln Flight Frequency	1.346***	1.311***	1.370***
	[0.037]	[0.035]	[0.201]
Ln PcGDP c1	0.500***	-0.213	-0.362
	[0.068]	[0.546]	[0.879]
Ln PcGDP c2	-0.116	-0.143	-0.716
	[0.147]	[0.607]	[0.859]
Ln Population c1	0.198***	-2.342	-1.274
	[0.049]	[1.656]	[2.554]
Ln Population c2	0.224***	-2.029	-0.826
	[0.041]	[1.684]	[2.558]
Ln Urban Density c1	-0.569**	0.126	0.133
	[0.241]	[1.801]	[3.462]
Ln Urban Density c2	-0.356	-0.748	-0.240
	[0.222]	[1.916]	[3.425]
Ln Distance (weighted)	-0.520***	-1.290***	-0.488
	[0.132]	[0.140]	[0.428]
Ln Trade	0.014	0.030	0.029
	[0.012]	[0.021]	[0.023]
1 = Common Border	-0.791***	-1.212***	-1.451***
	[0.142]	[0.152]	[0.274]
1 = Common Language	0.099	0.828***	0.677***
	[0.097]	[0.113]	[0.239]
Country FE	NO	YES	YES
Year FE	YES	YES	YES
Observations	515	515	515
R-squared	0.703	0.780	0.765
F-stat			4.672
Hansen J stat			14.85
Hansen J p-val			0.002

Robust standard errors in brackets

Air Fare Regression

	(1) OLS	(2) OLS	(3) 2SLS
Ln Passengers	-0.018*	0.001	-0.071*
	[0.010]	[0.010]	[0.037]
1 = Partial Liberalization	-0.053**	-0.112**	-0.177**
	[0.021]	[0.040]	[0.078]
1 = Full Liberalization	-0.110***	-0.147***	-0.166**
	[0.026]	[0.038]	[0.078]
Ln Number Airlines	-0.066	-0.163*	-0.053
	[0.047]	[0.077]	[0.072]
Ln Avg Aircraft Size	-0.535***	-0.525***	-0.371***
	[0.074]	[0.101]	[0.128]
Ln Fuel Cost	0.080	0.065	0.070
	[0.069]	[0.075]	[0.091]
Ln PcGDP c1	0.077***	0.211	0.280
	[0.017]	[0.134]	[0.220]
Ln PcGDP c2	-0.021	-0.025	-0.012
	[0.014]	[0.146]	[0.213]
Ln Distance (weighted)	0.832***	0.827***	0.654***
	[0.062]	[0.084]	[0.114]
Country	NO	YES	YES
Year FE	YES	YES	YES
Observations	515	515	515
R-squared	0.622	0.768	0.732
F-stat			5.142
Hansen J stat			12.89
Hansen J p-val			0.012

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.10

Flight Frequency Regression

	(1) OLS	(2) OLS	(3) 2SLS
Ln Passengers	0.445***	0.408***	0.405***
	[0.040]	[0.043]	[0.060]
1 = Partial Liberalization	0.088	0.022	0.019
	[0.072]	[0.194]	[0.167]
1 = Full Liberalization	0.007	-0.043	-0.044
	[0.092]	[0.219]	[0.159]
Ln Number Airlines	0.624***	0.543***	0.548***
	[0.055]	[0.076]	[0.144]
Ln Avg Aircraft Size	-0.353***	-0.472***	-0.466**
	[0.092]	[0.137]	[0.197]
Ln Total AirLinks c1	0.105	0.264	0.263*
	[0.069]	[0.147]	[0.159]
Ln Total AirLinks c2	0.094	0.187	0.186
	[0.060]	[0.142]	[0.152]
Ln Distance (weighted)	0.522***	0.381***	0.375***
	[0.087]	[0.098]	[0.141]
Country	NO	YES	YES
Year FE	YES	YES	YES
Observations	515	515	515
R-squared	0.706	0.772	0.772
F-stat			6.787
Hansen J stat			6.126
Hansen J p-val			0.190

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.10

Market Competition Regression

	(1) OLS	(2) OLS	(3) OLS
1 = Partial Liberalization	0.028	-0.064	-0.092
	[0.027]	[0.056]	[0.059]
1 = Full Liberalization	0.113***	0.100	0.071
	[0.026]	[0.055]	[0.058]
Ln Total AirLinks c1	-0.024	0.374***	0.353***
	[0.020]	[0.095]	[0.102]
Ln Total AirLinks c2	0.075***	0.233**	0.287**
	[0.020]	[0.090]	[0.114]
Ln Trade			0.010
			[0.006]
Ln GDP c1			-0.036
			[0.118]
Ln GDP c2			-0.107
			[0.147]
Ln Distance (weighted)	-0.586***	-0.554***	-0.547***
	[0.014]	[0.012]	[0.027]
Country	NO	YES	YES
Year FE	YES	YES	YES
Observations	515	515	515
R-squared	0.365	0.672	0.676

Robust standard errors in brackets
*** p<0.01, ** p<0.05, * p<0.10

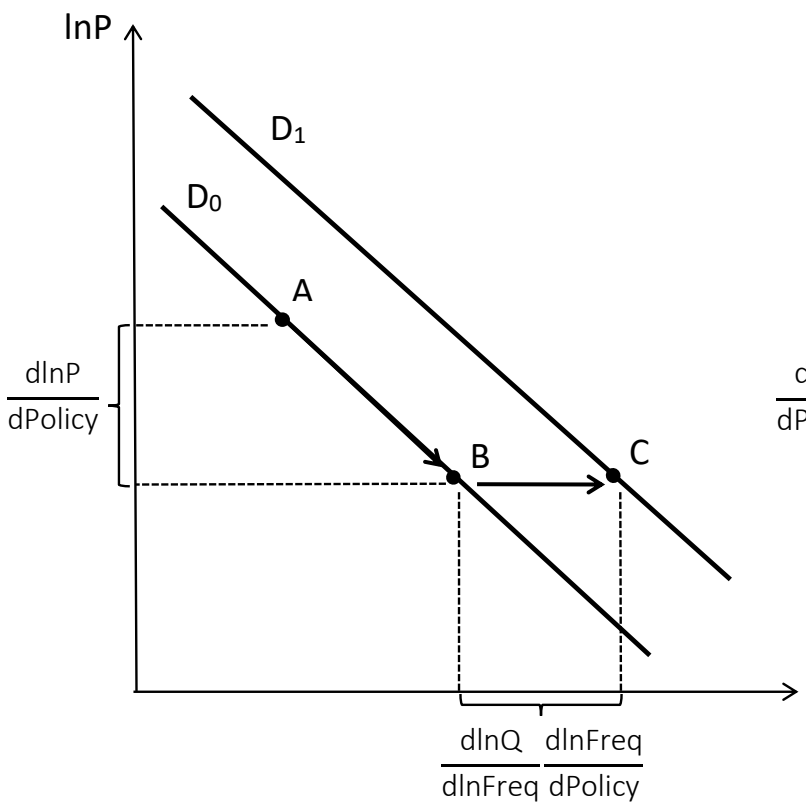
Summary of BASA Liberalization Results

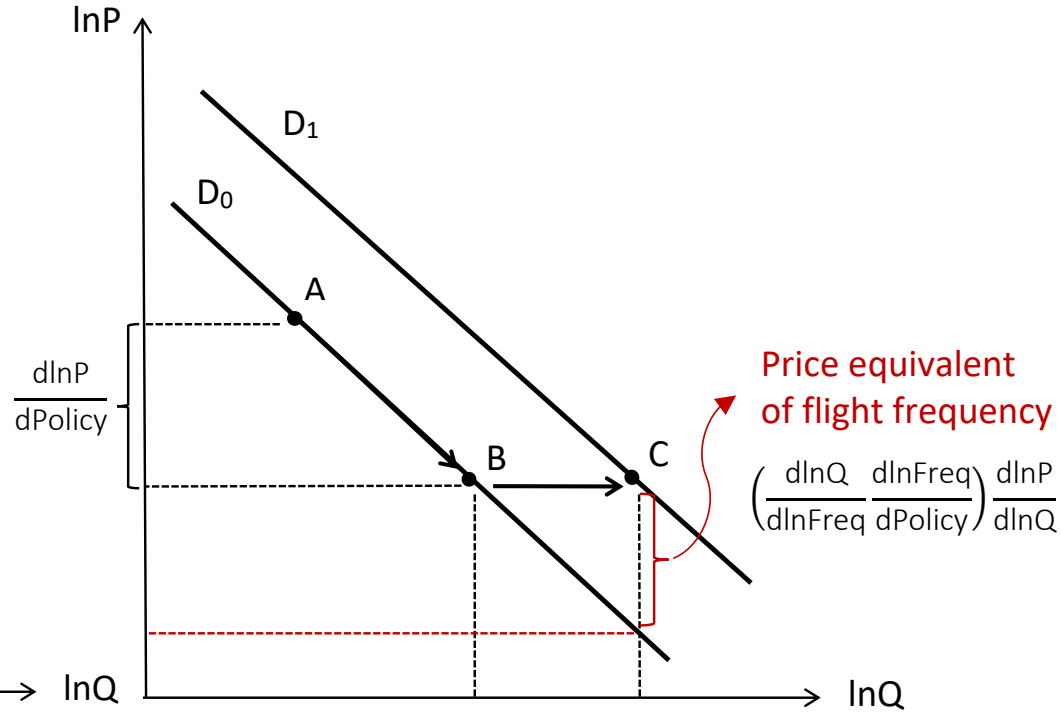
- **Air fares:**
  - → Direct effects: **16.2% fall** from partial liberalization
  - → Direct effect: **15.3% fall** from full liberalization
- **Passenger volumes:**
  - → NO direct effect (by construction)
  - → Indirect effect (airfare↓): **30% growth** from partial/full lib.
- **Flight frequency:**
  - → NO (estimated) direct effect
  - → Indirect effect (pax↑): **28% growth** from partial/full lib.
- **Market competition:**
  - → NO (estimated) direct or indirect effects

Summary of BASA Liberalization Results

- Partial effects (direct & indirect) are informative on their own
- For policy analysis:
  How to aggregate partial effects into a cumulative statistics?
- **Price-equivalent effect** of BASA liberalization:
  - use price elasticities to convert quantity units intro price effects
  - aggregate direct and indirect price effects into a total effect
- Graphically...

Price-equivalent Effect of BASA Liberalization





Price-Equivalent Effect of BASA Liberalization

	Estimated Effects of Air Liberalization			
	Partial Liberalization		Full Liberalization	
	OLS	2SLS	OLS	2SLS
Total Price Effect:	**- 0.112**	**- 0.227**	**- 0.146**	**- 0.213**
Of which:				
Direct Effect:	- 0.112	- 0.177	- 0.147	- 0.166
Indirect Effect via Quantity:	0.000	0.050	0.000	- 0.047
Total Frequency Effect:	0.046	0.288	0.060	0.270
Of which:				
Direct Effect:	0.000	0.000	0.000	0.000
Indirect Effect via Quantity:	0.046	0.288	0.060	0.270
Price Equivalent of Frequency Effect:	**- 0.129**	**- 0.284**	**- 0.168**	**- 0.266**
Total Price Effect of Air Liberalization	**-0.241**	**- 0.511**	**-0.314**	**- 0.480**

⇒ Liberal BASAs generate **benefits equivalent to a 48–51% fall in air fares**

Consumer Welfare Calculations

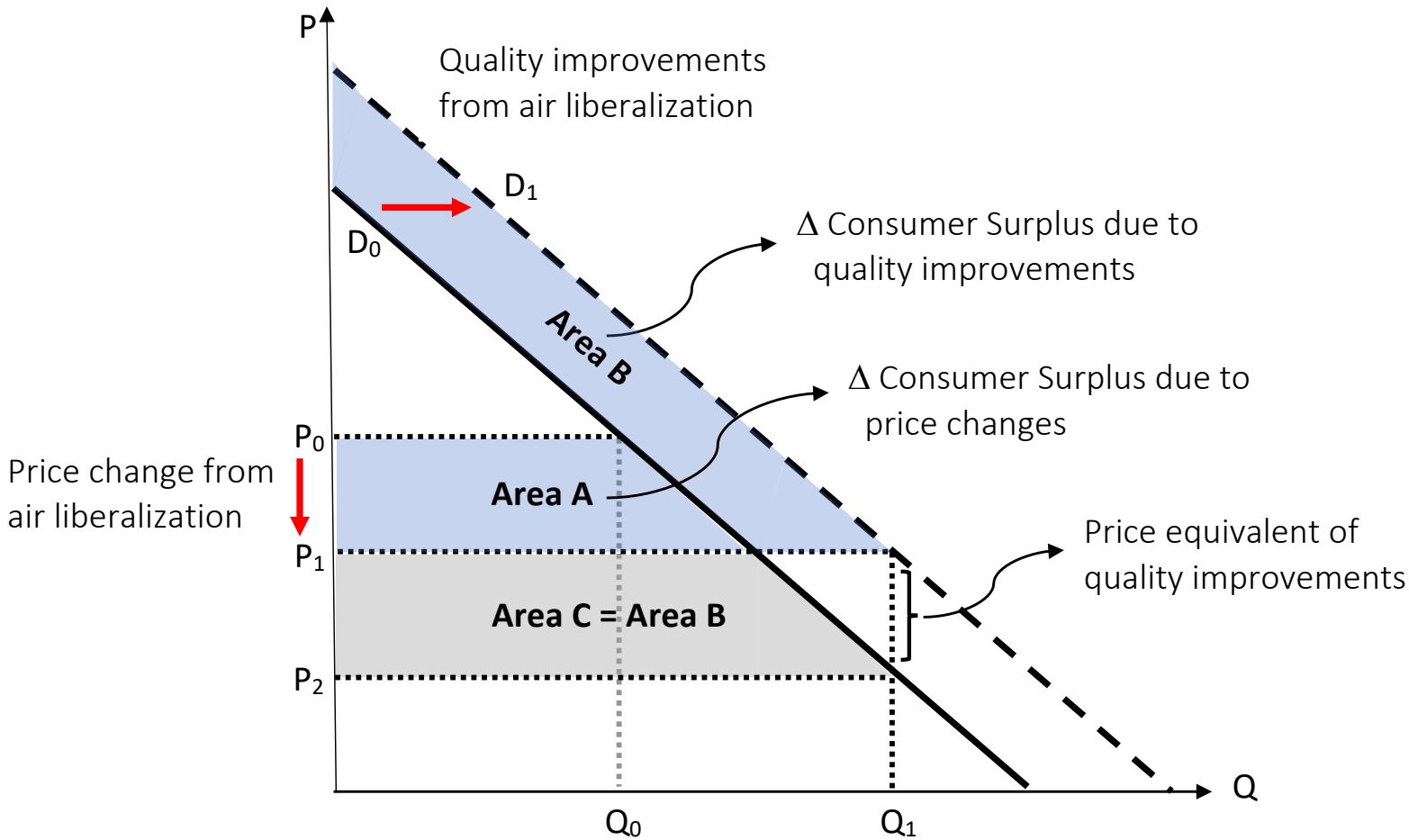
- Main idea:

  $\rightarrow$ use the price equivalent effect of BASA liberalization to calculate welfare changes

- Approaches to welfare calculations:

  1. **Change in Consumer Surplus**
  2. **Compensating Variation**

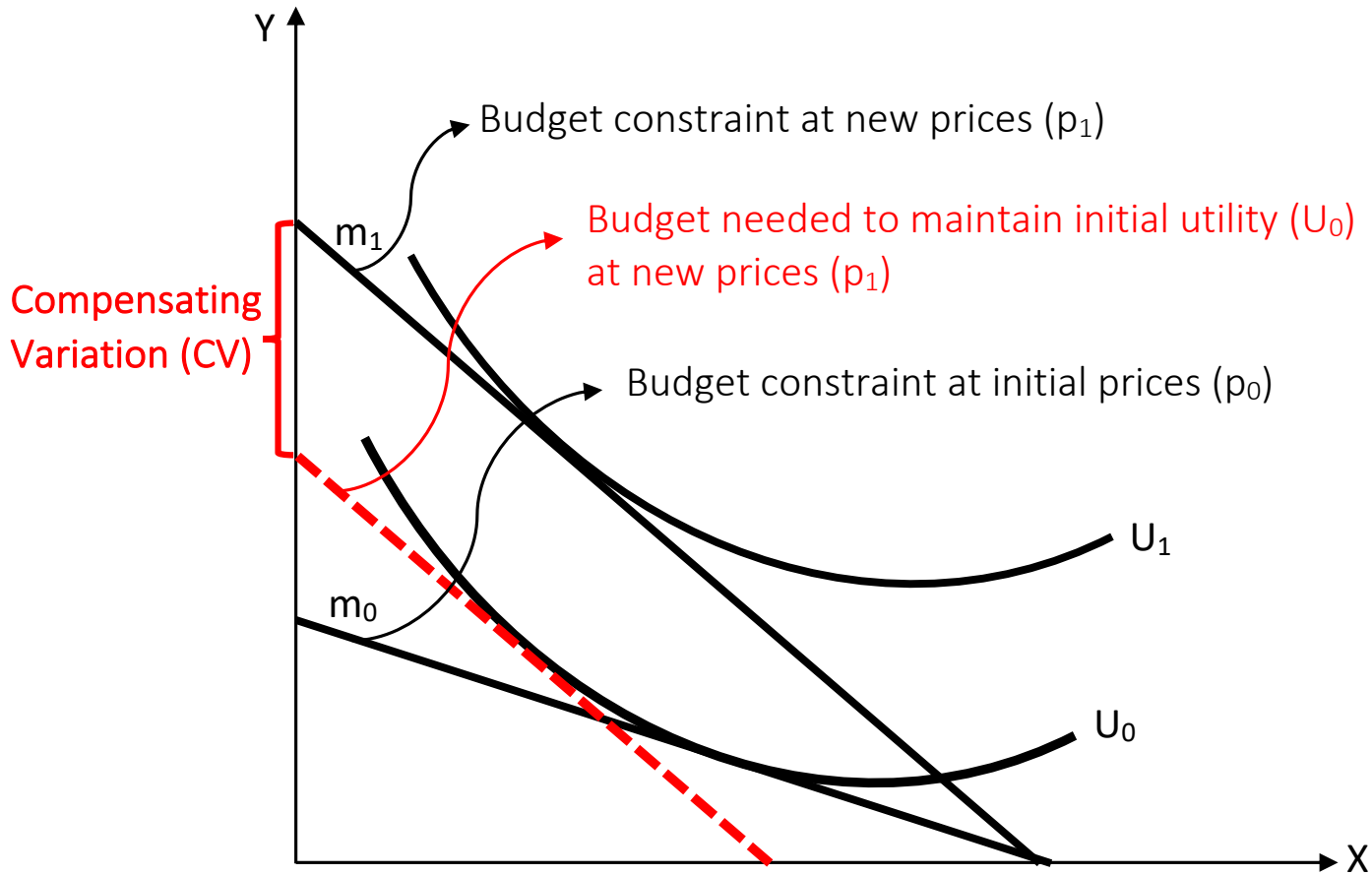
Change in Consumer Surplus



Change in Consumer Surplus

	Welfare Effects: Δ Consumer Surplus		
Year	Fare Savings to Existing Pax (mil USD)	New Passenger Gains (mil USD)	Total Increase in Consumer Surplus (mil USD)
2011	190.01	151.62	341.63
2012	202.81	162.56	365.36
2013	224.97	177.48	402.45
2014	285.29	223.85	509.14
2015	263.45	207.55	471.00
2016	262.91	206.96	469.88
2017	249.08	192.24	441.32
2018	301.99	232.29	534.28
2019	290.26	223.11	513.37

Compensating Variation



Compensating Variation

Year	Air Travel Revenue (mil USD)	Welfare Effects: Compensating Variation			
		Partial Lib. (mil USD)	Full Lib. (mil USD)	Total Gains (mil USD)	% of Travel Revenue
2011	1037.539	98.00	92.01	190.01	18.31
2012	1138.599	111.18	91.63	202.81	17.81
2013	1099.392	97.58	127.39	224.97	20.46
2014	1138.051	112.76	172.53	285.29	25.07
2015	1062.553	111.72	151.73	263.45	24.79
2016	1054.07	110.03	152.88	262.91	24.94
2017	998.2566	69.61	179.47	249.08	24.95
2018	1174.156	77.29	224.70	301.99	25.72
2019	1135.406	72.89	217.37	290.26	25.56

Summary of Consumer Welfare Calculations

- BASA liberalization generates consumer benefits equivalent to **48–51%** fall in air fares
- Consumer welfare gains range between **290-ml and 513-ml US$** for year 2019

Caveats and Considerations

Important to note:

- Welfare calculations only consider the consumer side

  $\rightarrow$ Producer surplus and government revenues are left out

- No account of domestic aviation policies

  $\rightarrow$ Administrative hold-ups like airport charges and fees

  $\rightarrow$ Domestic market competition and entry barriers

  $\rightarrow$ Other domestic factors

Conclusions

- Contribution of *Bilateral Air Service Agreements (BASAs)* to the growth and development of air passenger transport within Africa

- Find direct evidence that BASA liberalization

  – reduces air fares
  – increases air traffic
  – increases flight frequency

  $\Rightarrow$ equivalent to a price reduction of 48-51%

- Consumer welfare gains range between 290-513 ml. US$