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Appendix



Figure A1: Average Network Speed and WorldPop Population Estimate

Figure A2: Gridded GDP and International Wealth Index





Figure A3: Imputed International Wealth Index using Database of Krantz (2023)

Predicted International Wealth Index: Imputed With MissForest, R-Squared = 0.970

Notes: The high R^2 is not surprising as the estimates of Lee & Braithwaite (2022) also utilize many features from OSM in their methodology and Random Forests is very flexible. A concern with the imputation is that the relationship between infrastructure and wealth may be different south of the Sahara. Lee & Braithwaite (2022) mention the absence of (recent) DHS surveys in North Africa as an obstacle to extending their methodology to them. Their success in estimating cross-country models for all of SSA, including South Africa, however suggests that these models - approximated by *MissForest* - should also provide acceptable predictions in North Africa.



Figure A4: Market Access Maps using Total IWI-Based Wealth

 $\theta=3.8$ (Jedwab & Storeygard, 2022), cor(MA, Wealth) = 0.876-0.966





Figure A5: Market Access Maps using GDP in 2015 USD PPP: With Frictions











Figure A6: Market Access Maps using Total IWI-Based Wealth: With Frictions

 $\theta=3.8$ (Jedwab & Storeygard, 2022), cor (MA, Wealth) = 0.875-0.966





Figure A7: Market Access Loss (%) from Border Frictions using Total IWI-Based Wealth



Figure A8: Optimized Full Network Graph: Duration Weighted Edges



Figure A9: Discretized Trans-African Network Plus Original Routes



Figure A10: Discretized Trans-African Network and New Links for US Route Efficiency



Figure A11: Local Road Distance Reduction: $\min(\kappa_{ik}^r) = 0.85$

 $\label{eq:Figure A12: Estimated Network Building Cost per Kilometer} Total Network Building Cost Estimate \\ New Links + Algeria-Morocco 3 \times Cheaper$



Figure A13:Nightlights vs. IWI to Measure City ProductivityNightlights/Capita (20km Buffer)IWI by Lee & Braithwaite (2022)







Figure A14:Optimal \$50B Investments, Trade, and Welfare by σ $\sigma = 1.5$, Welfare Gain = 5.84% $\sigma = 2$, Welfare Gain = 1.80% $\sigma = 4$, Welfare Gain = 0.19%

Figure A15: Optimal Infrastructure Allocation Without Imported Goods





Figure A16: Ratio of Goods Flows under Border Frictions to Frictionless Flows



Figure A17: Flow of Goods and Local Consumption under IRS



Figure A18: Optimal \$50B Investments, Trade, and Welfare under IRS by σ

Figure A19: Optimal Infrastructure Allocation Without Imported Goods: IRS Case





Figure A20: Ratio of Goods Flows under Border Frictions to Frictionless Flows: IRS Case



Figure A21: Trans-African Network Connecting Large Cities: Parameterization with Real Roads



Figure A22: Flow of Goods Through Trans-African Network Connecting Large Cities

Flow 1.2 4.0 1.10 -5.0 -60.0 -140.0 Dar es Salaam – Tanzania



Figure A23: Optimal \$10B Trans-African Investments and Trade by σ





Figure A24: Optimal \$10B Trans-African Investments by σ with Inequality Aversion ($\rho = 2$) $\sigma = 2$, Welfare Gain = 0.48% $\sigma=3.8,$ Welfare Gain = 0.038% $\sigma = 5$, Welfare Gain = 0.019%

1.0 3.0 6.5 14.0 27.5 55.0

Flow

1.00 2.75 6.00 12.50 25.00

Flow

1.00 -2.75 -6.00 -12.50 -25.00 -50.00

Flow

1.0 3.0 6.5 14.0 27.5 55.0 110.

Flow

1.2 4.0 9.0 22.5 50.0

1.2 4.0 9.0 22.5 50.0 100.0



Figure A25: Flow of Goods Through Trans-African Network Connecting Large Cities: IRS Case

Figure A26:Optimal Trans-African Network Investments under Increasing ReturnsFinal Network SpeedInvestments in km/hInvestments in % Complete





Figure A27: Optimal \$10B Trans-African Investments and Trade by σ : IRS Case

Figure A28: Optimal \$10B Trans-African Investments by σ with Inequality Aversion ($\rho = 2$): IRS Case



80

1.5 5.0 12.5 32.5 80.0

1.5 5.0 12.5 32.5 80.0

Nairobi – Kenya

1.5 5.0 12.5 32.5 80.0

Flov

1.5 5.0 12.5 32.5 80.0

Khartoum – Sudan

1.8 6.0 -20.0 -55.0 -150.0

Flov

1.8 6.0 -20.0 -55.0 -150.0

Nairobi – Kenya

1.8 6.0 20.0 55.0 150.

1.8 6.0 20.0 55.0

Khartoum – Sudan

1.5 -4.5 -12.5 -30.0 -75.0 -175.0

Flow

1.5 4.5 12.5 30.0 75.0

Nairobi – Kenya

1.5 4.5 12.5 30.0 75.0

Flow

1.5 4.5 12.5 30.0 75.0

Khartoum – Sudan



Figure A29: Flow of Goods Through Trans-African Network: Fastest and Shortest Routes

Flow 1.5 -6.0 -17.5 -45.0 -125.0 -300.0

Flow

1.5 6.0 17.5 45.0 125.0 300.0

81



Figure A30: Optimal \$10B and \$20B Trans-African Investments by σ - Infrastructure

Difference under Border Frictions (\$20B Planner)













Welfare Gain (%) - 25 to 50 5 50 to 100 - 100 or more

Gain = 2.05%, r(IWI) = -0.16





With Border Frictions Gain = 0.20%, r(IWI) = -0.10





Gain = 0.09%, r(IWI) = -0.08



Figure A31: Welfare gains by σ : Standard and Frictions Scenarios



Figure A32: Optimal \$10B Trans-African Investments & Welfare with Inequality Aversion by σ

Figure A33: Optimal \$10B Trans-African Investments & Welfare with Increasing Returns by σ

 $\sigma=2,$ Completes 26,255km

 $\sigma = 3.8$, Completes 26,849km

 $\sigma=5,$ Completes 27,056km







Inequality Averse Planner: Builds 48,370km



 % UG Product
 0
 Small City

 20
 City > 200K

 40
 Port

 50
 City > 200K

 40
 Port

 60
 Port-City

 80
 Megacity (Own)

Inequality Averse IRS Planner: Builds 59,487km



Figure A35: Optimal \$20B Trans-African Flows & Welfare on Large Network with $\sigma = 1.5$ Standard Planner **Increasing Returns Planner**

Flow



Kano – Nigeria Kinshasa – Congo Flow 2 10 -32 -100 -350

Own Consumption Share: $>\!78\%$



 $\uparrow 7.92\%$ [p1: -22%, p50: 10%, p99: 80%, r: -0.24]

· Less than -25

-25 to 0

0 to 25

25 to 50

50 to 100

• 100 or more

†14.3% [p
1: -5%, p50: 17%, p99: 84%, r: -0.25]

