Appendix

Figure A1: Average Network Speed and WorldPop Population Estimate

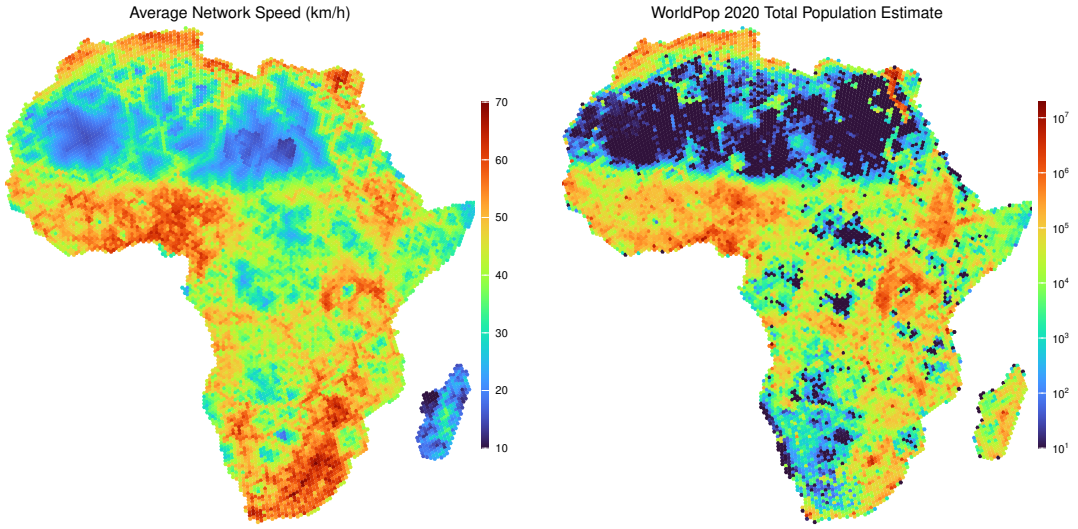
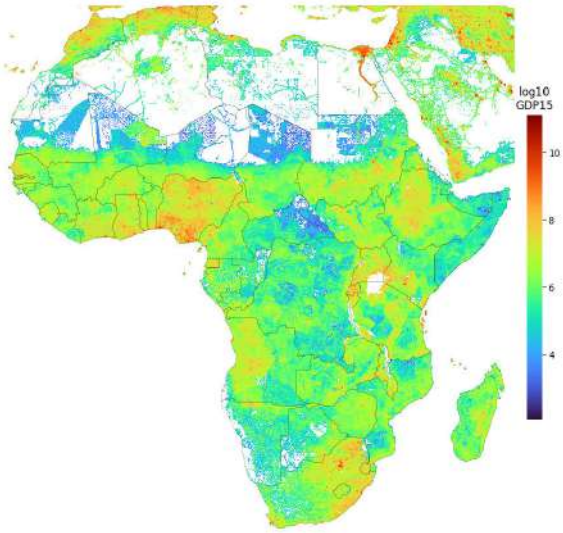


Figure A2: Gridded GDP and International Wealth Index

Gridded GDP PPP in 2015
(Kummu et al., 2018)



International Wealth Index (2017+)
(Lee & Braithwaite, 2022)

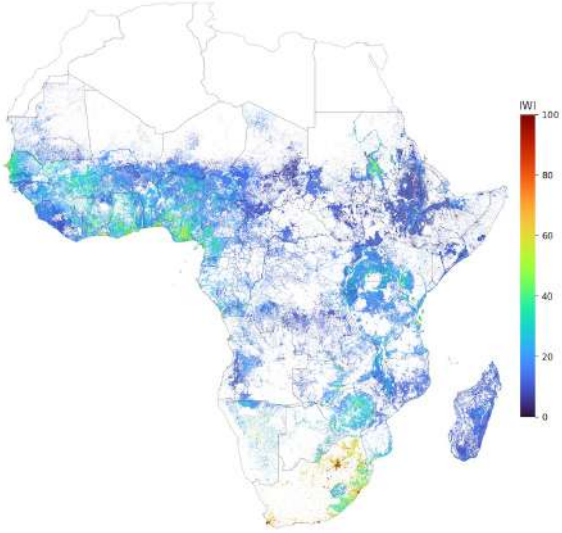
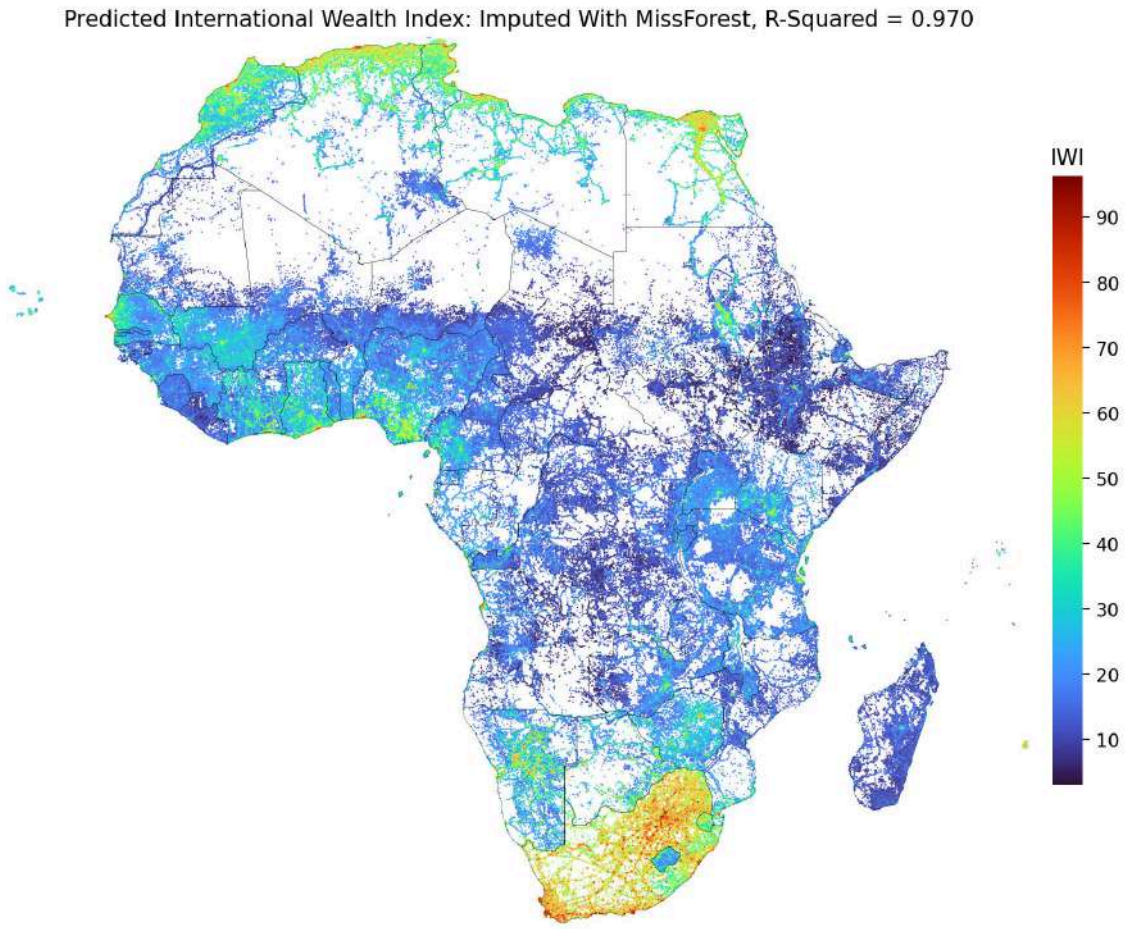


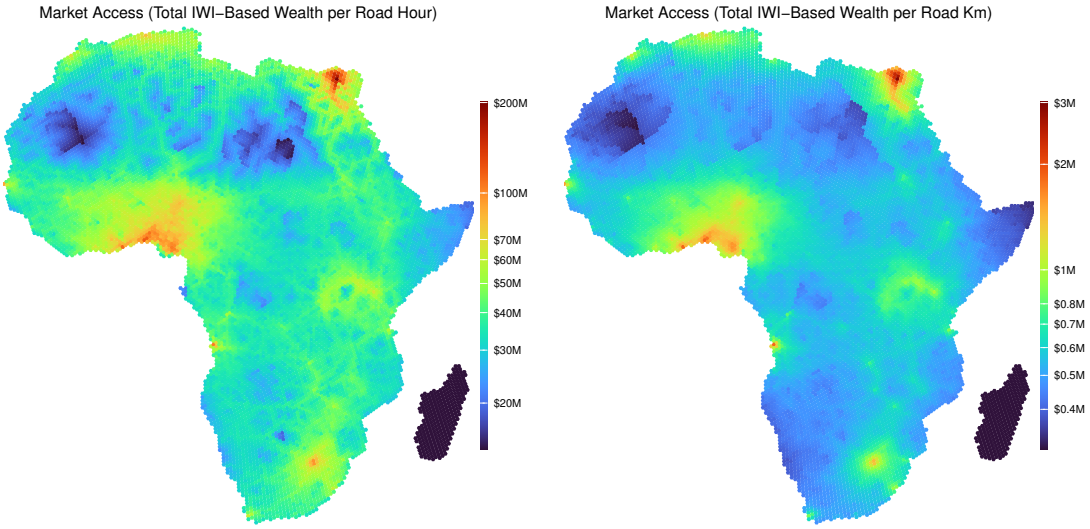
Figure A3: Imputed International Wealth Index using Database of Krantz (2023)



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

$\theta = 1$ (Peng & Chen, 2021), cor(MA, Wealth) = 0.389-0.406



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

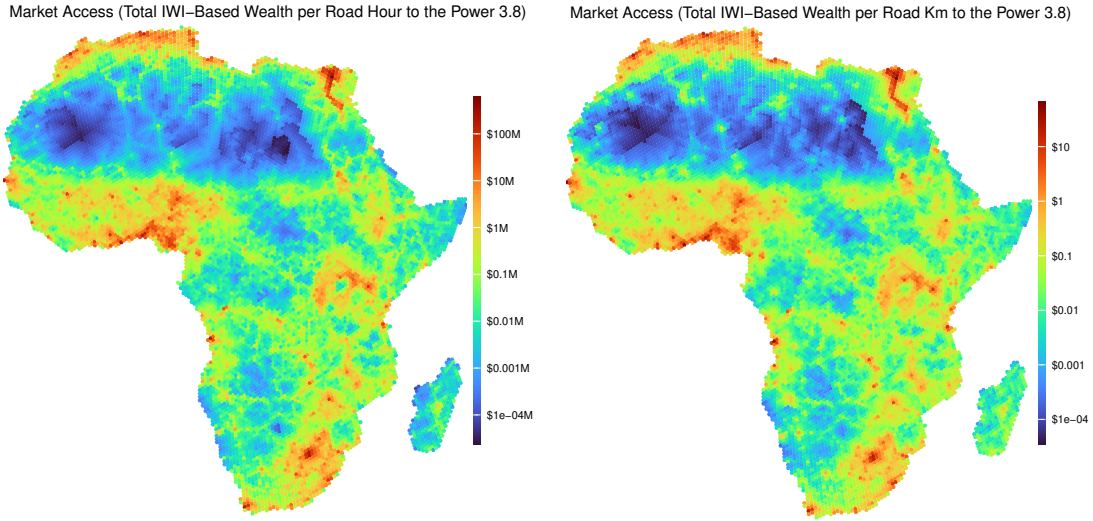
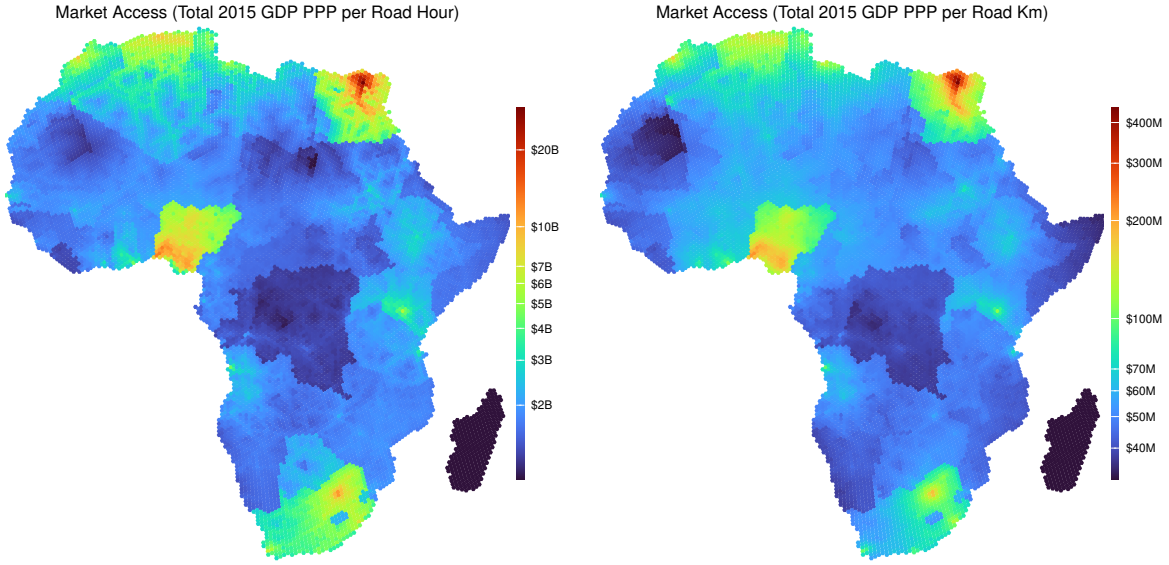


Figure A5: Market Access Maps using GDP in 2015 USD PPP: With Frictions

$\theta = 1$ (Peng & Chen, 2021), cor(MA, GDP) = 0.519-0.530



$\theta = 3.8$ (Jedwab & Storeygard, 2022), cor(MA, GDP) = 0.894-0.962

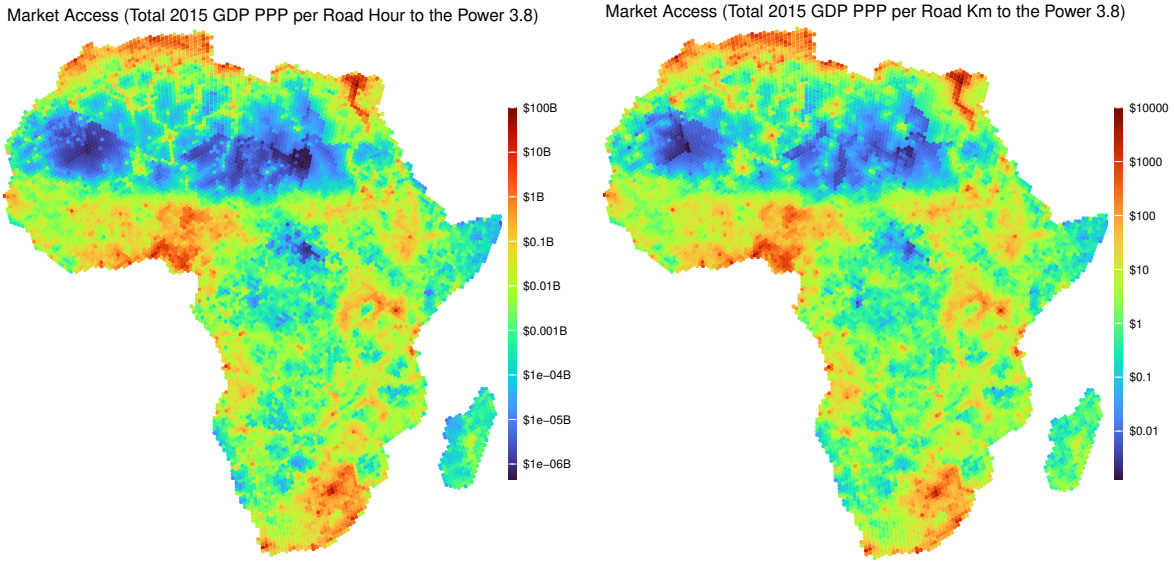
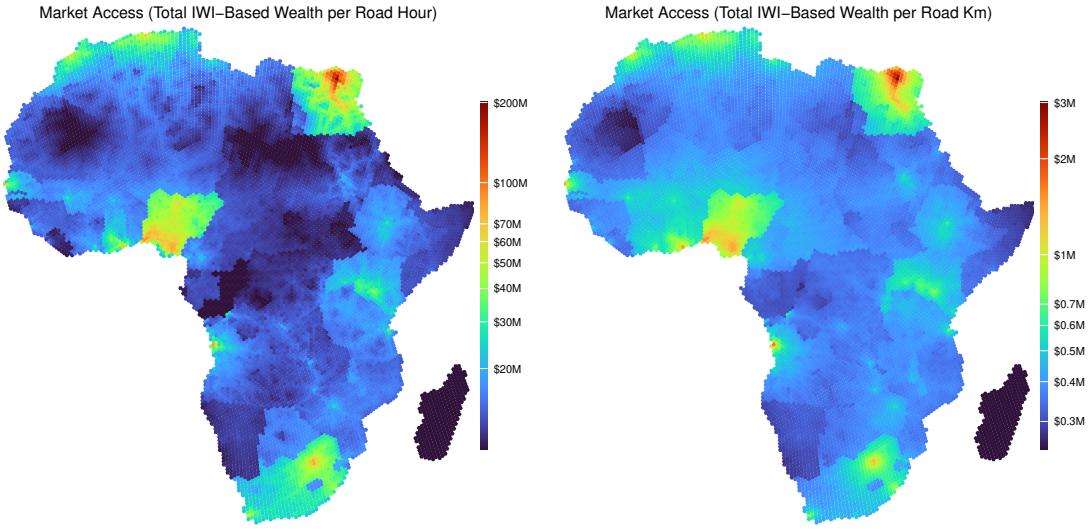


Figure A6: Market Access Maps using Total IWI-Based Wealth: With Frictions

$\theta = 1$ (Peng & Chen, 2021), cor(MA, Wealth) = 0.449-0.451



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

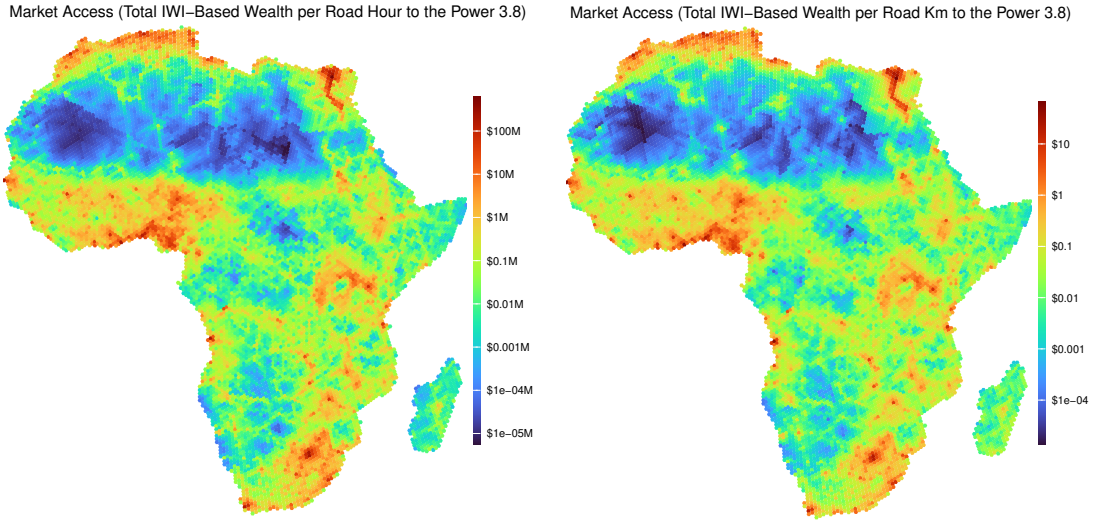
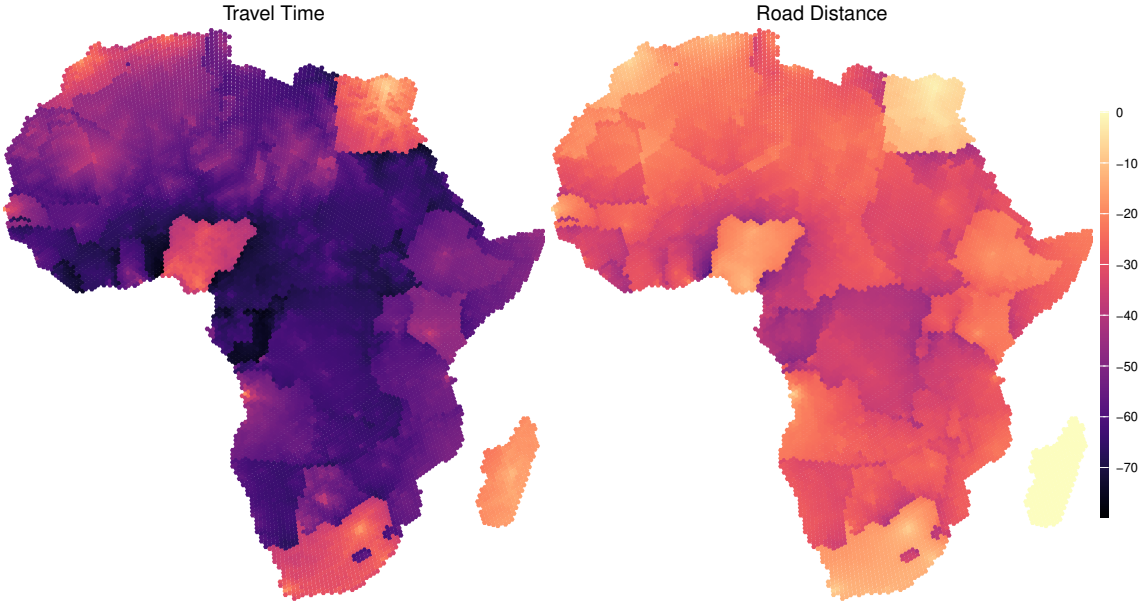


Figure A7: Market Access Loss (%) from Border Frictions using Total IWI-Based Wealth

$\theta = 1$ (Peng & Chen, 2021)



$\theta = 3.8$ (Jedwab & Storeygard, 2022)

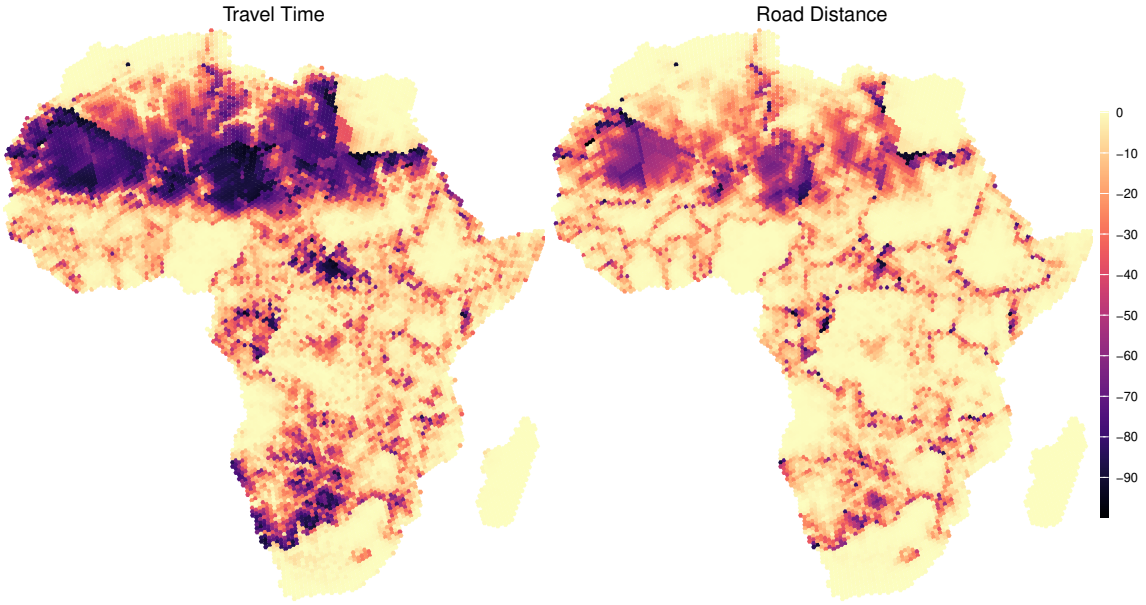


Figure A8: Optimized Full Network Graph: Duration Weighted Edges

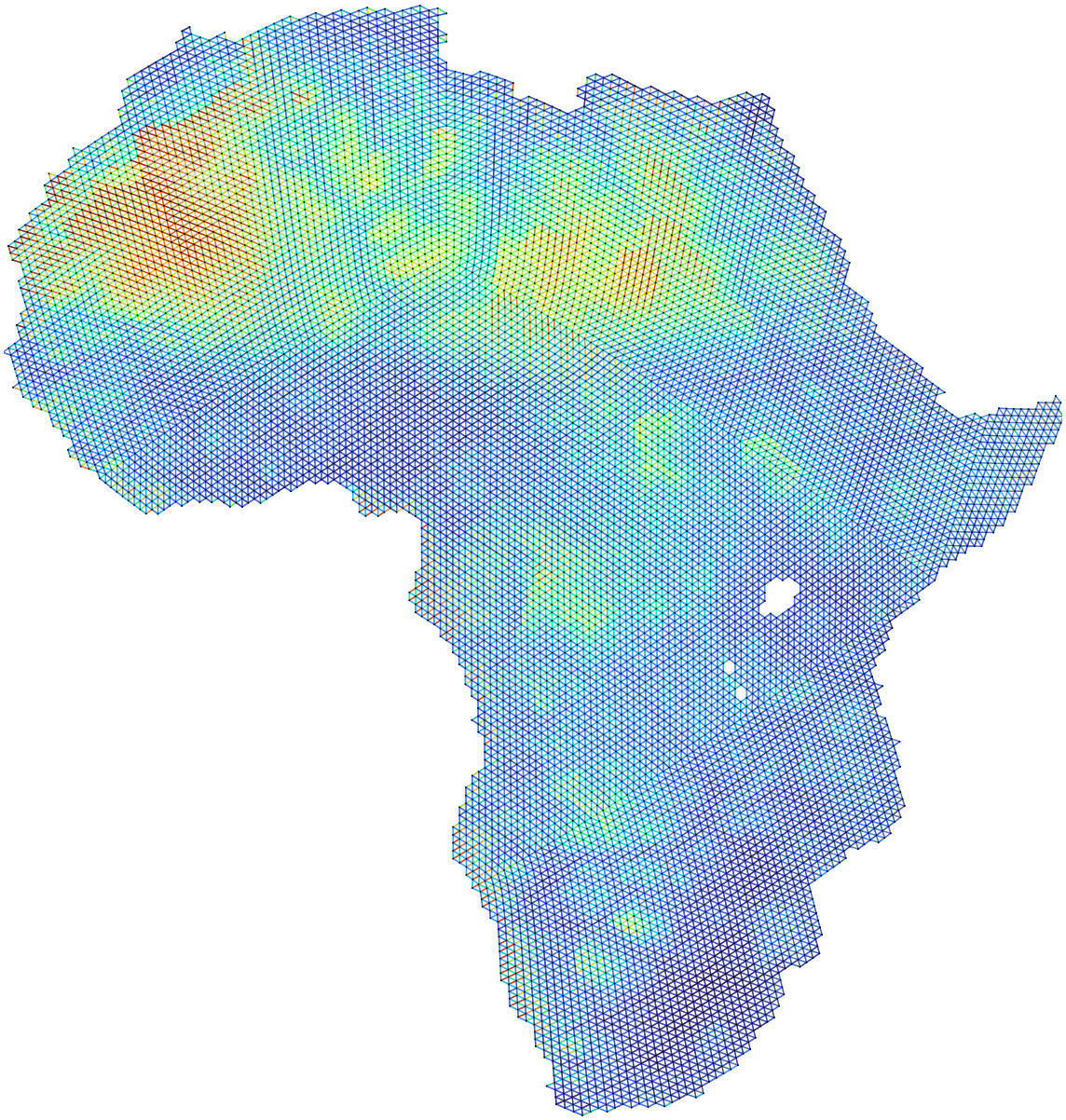


Figure A9: Discretized Trans-African Network Plus Original Routes

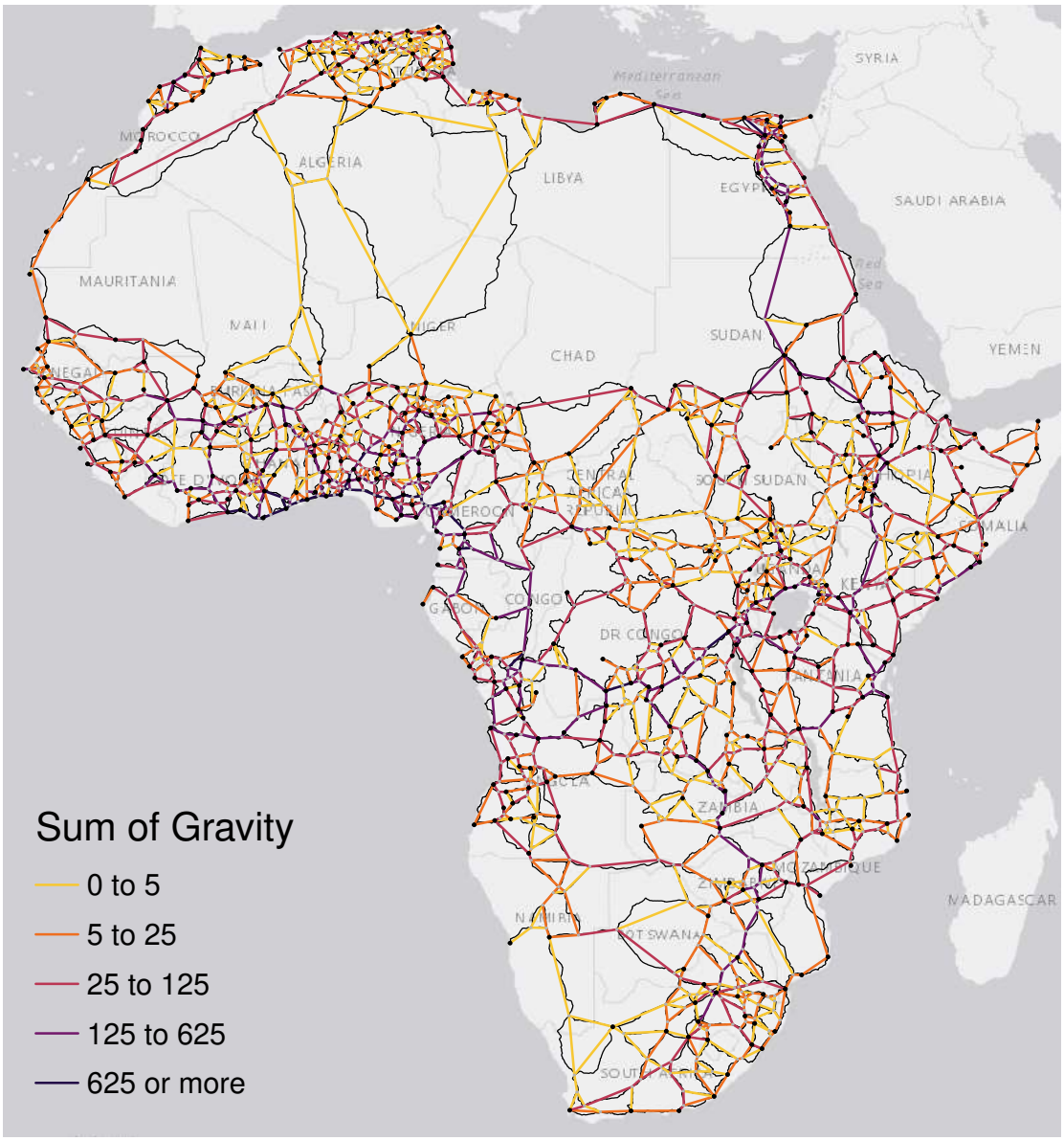


Figure A10: Discretized Trans-African Network and New Links for US Route Efficiency

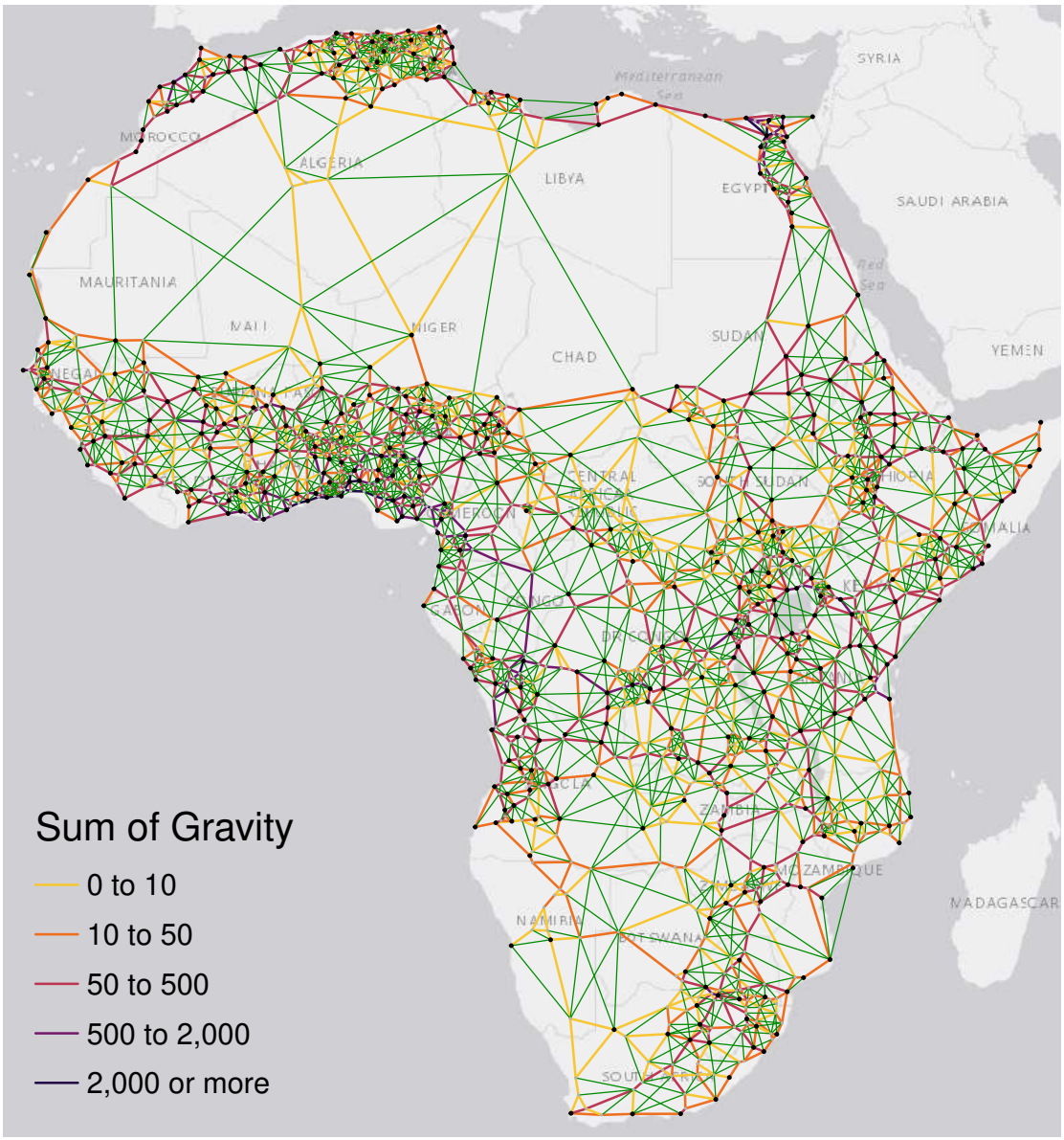


Figure A11: Local Road Distance Reduction: $\min(\kappa_{ik}^{r}) = 0.85$

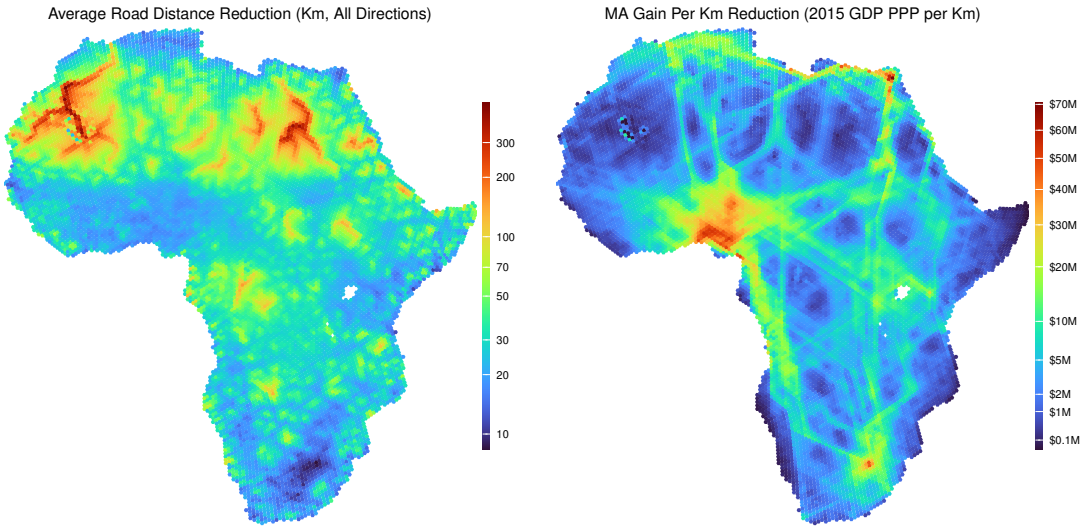


Figure A12: Estimated Network Building Cost per Kilometer

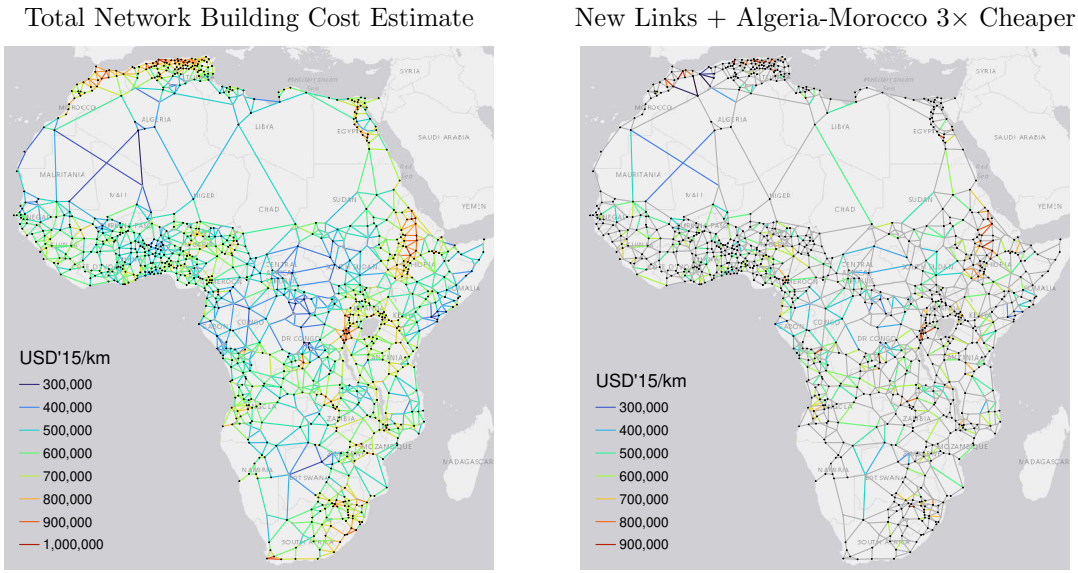


Figure A13: Nightlights vs. IWI to Measure City Productivity

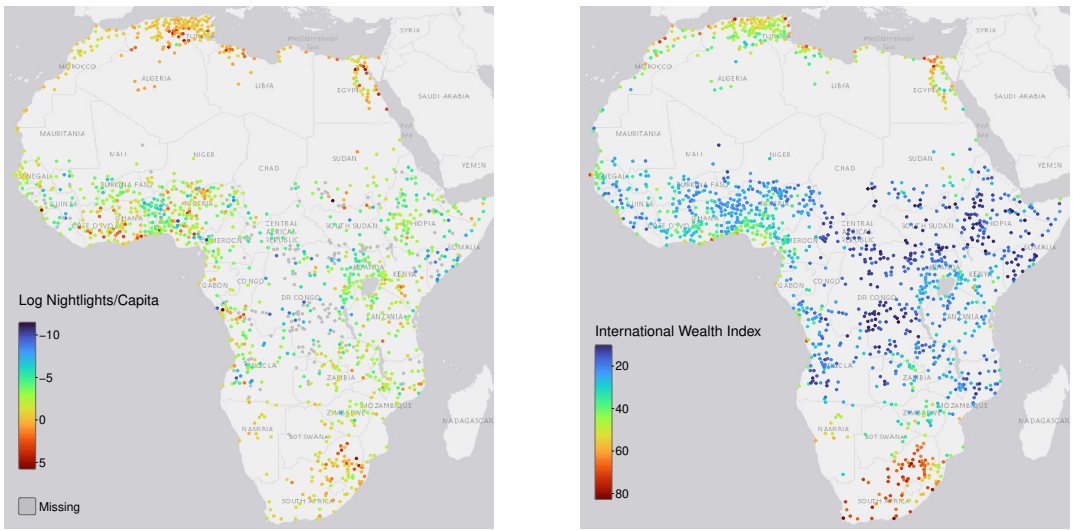


Figure A14: Optimal $50B Investments, Trade, and Welfare by σ

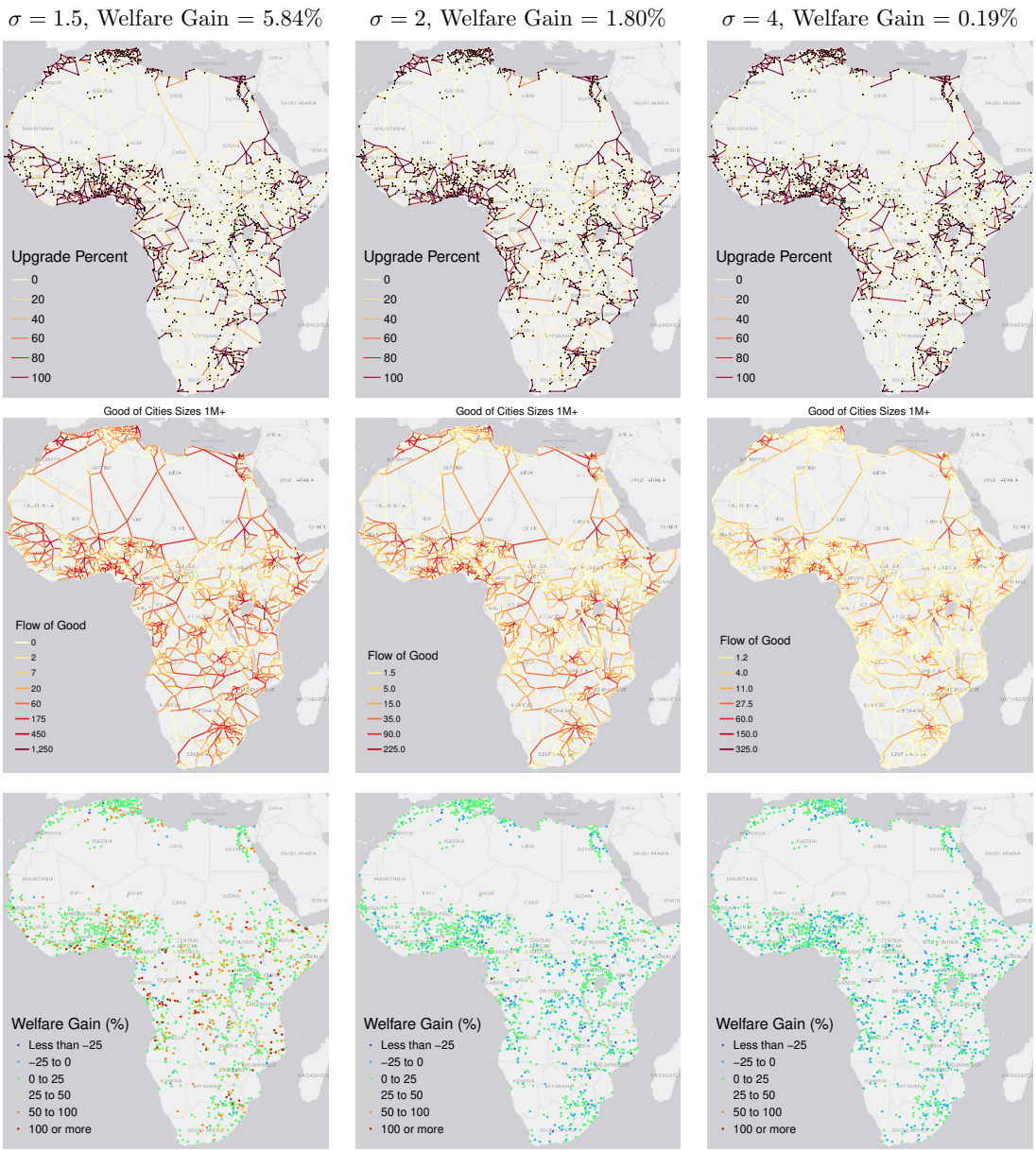


Figure A15: Optimal Infrastructure Allocation Without Imported Goods

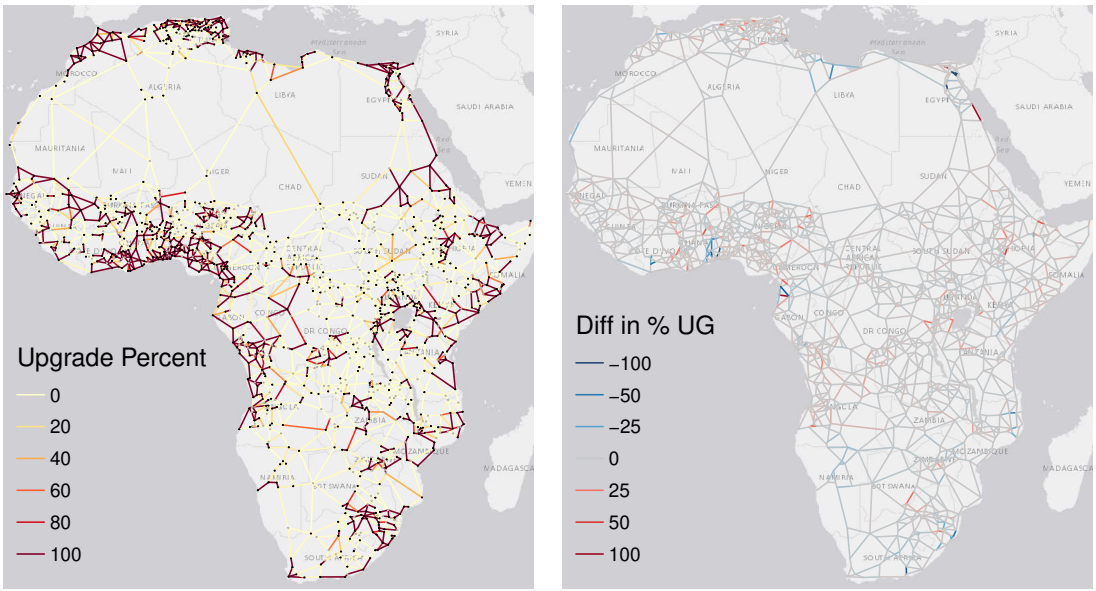


Figure A16: Ratio of Goods Flows under Border Frictions to Frictionless Flows

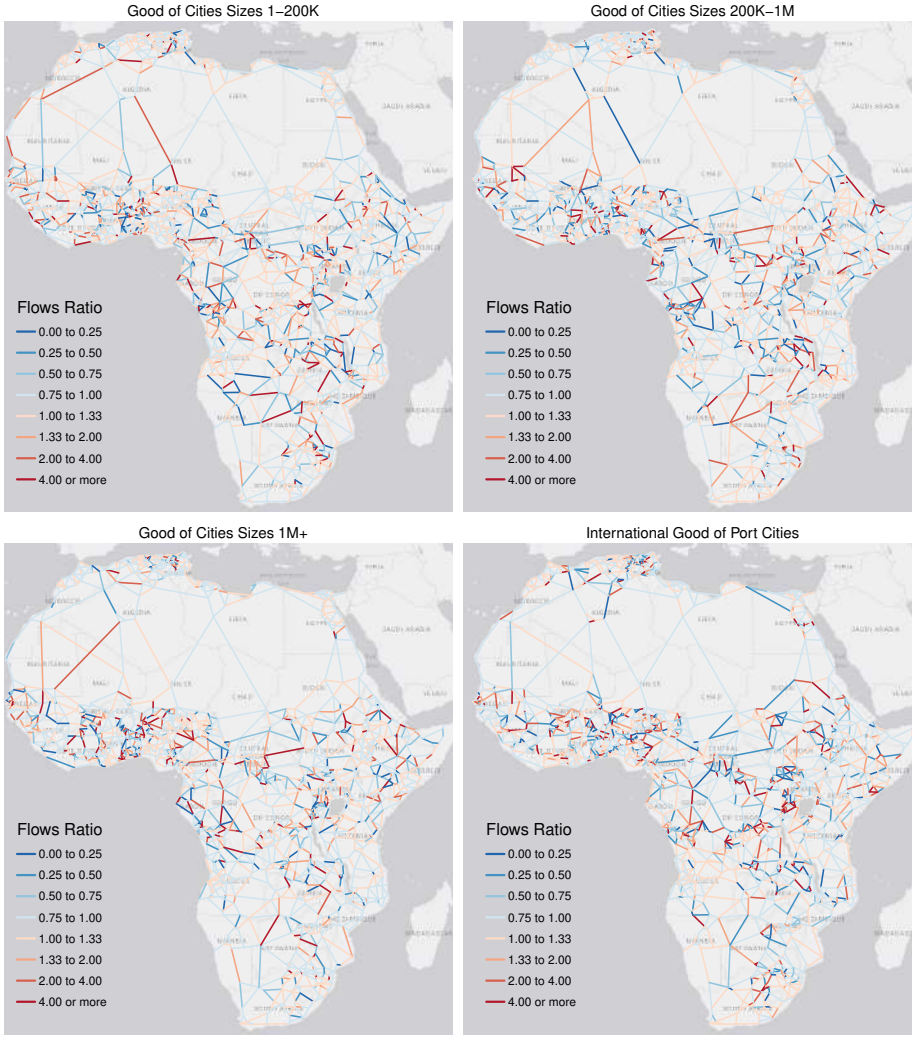


Figure A17: Flow of Goods and Local Consumption under IRS

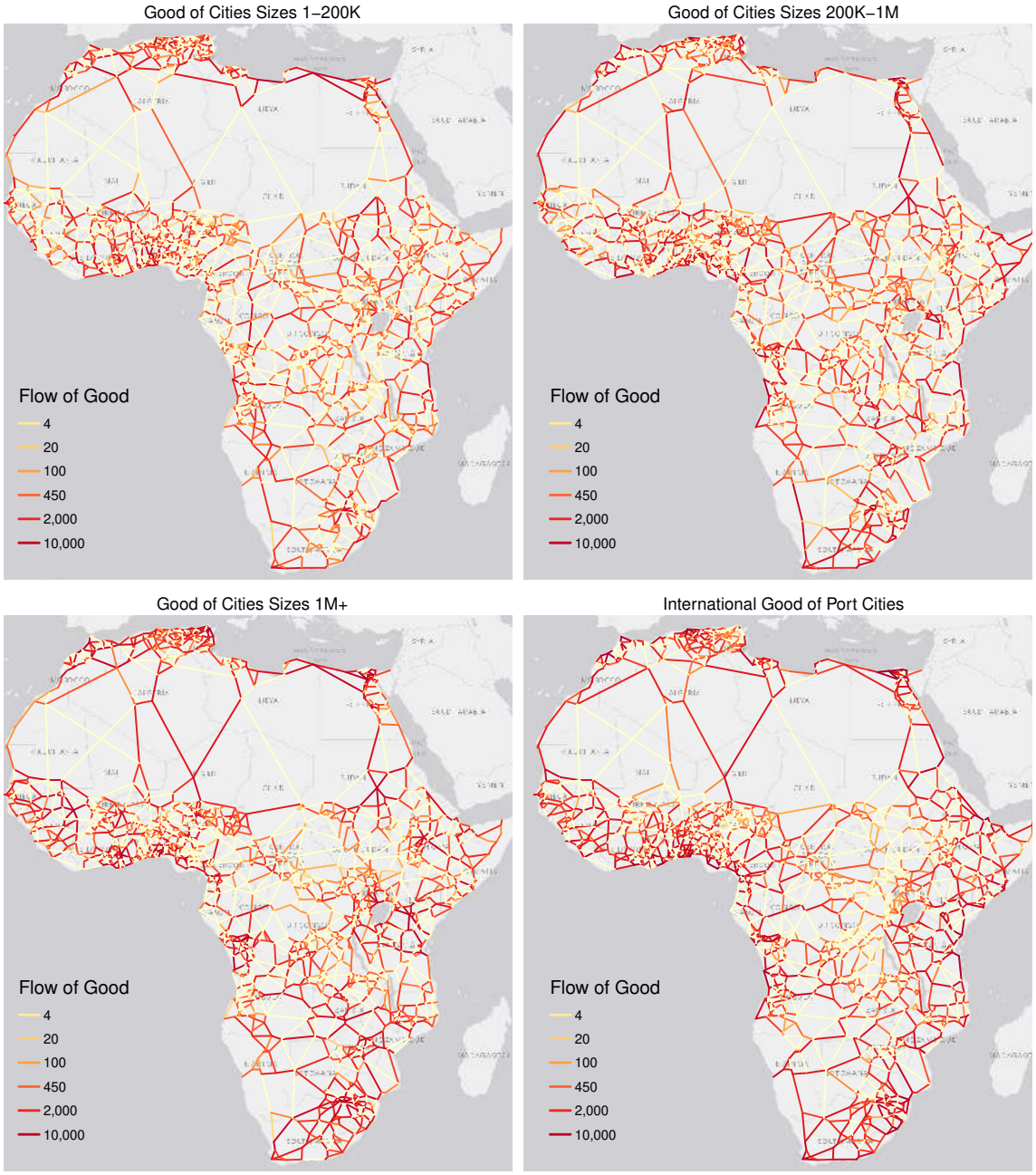


Figure A18: Optimal $50B Investments, Trade, and Welfare under IRS by σ

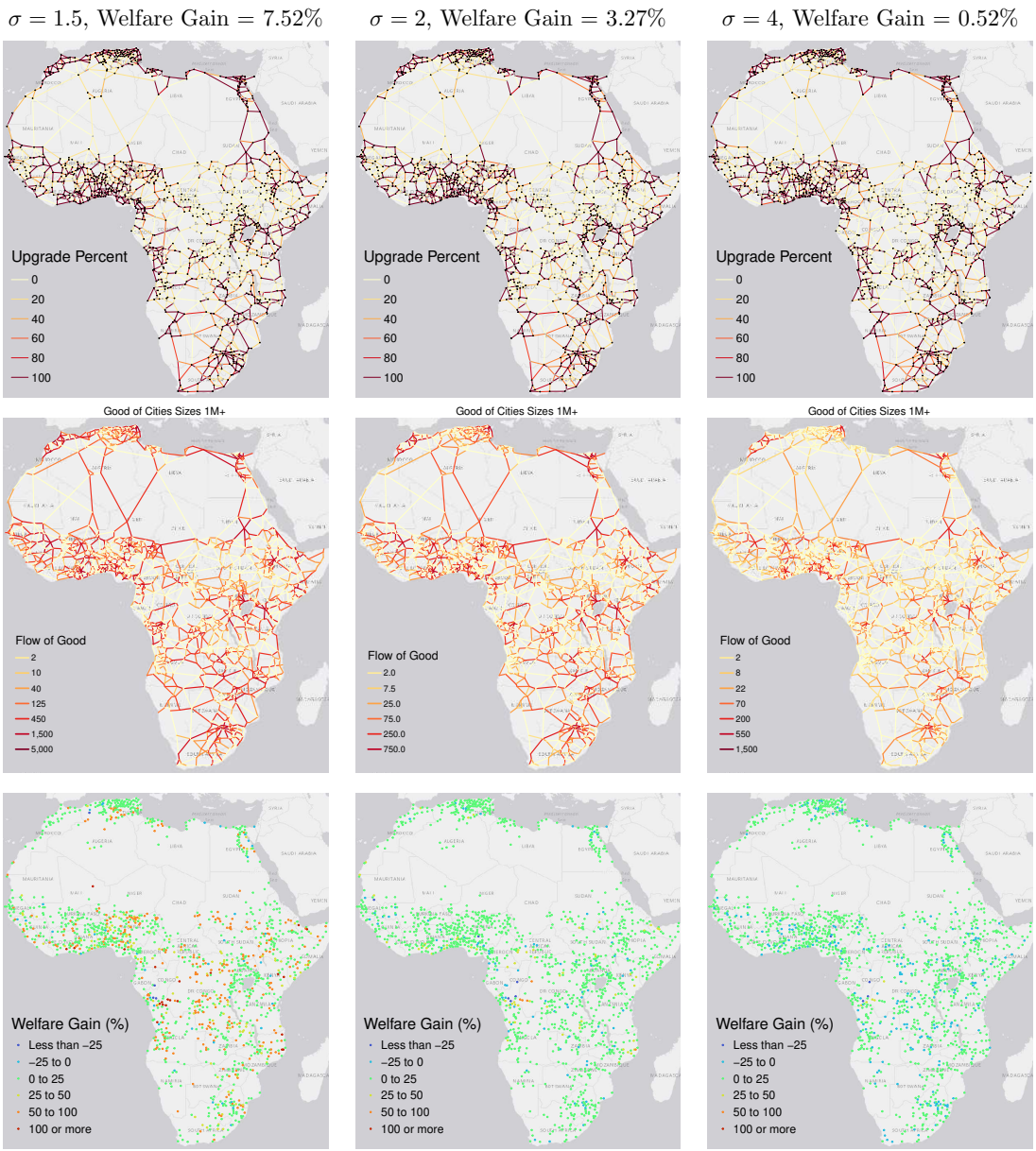


Figure A19: Optimal Infrastructure Allocation Without Imported Goods: IRS Case

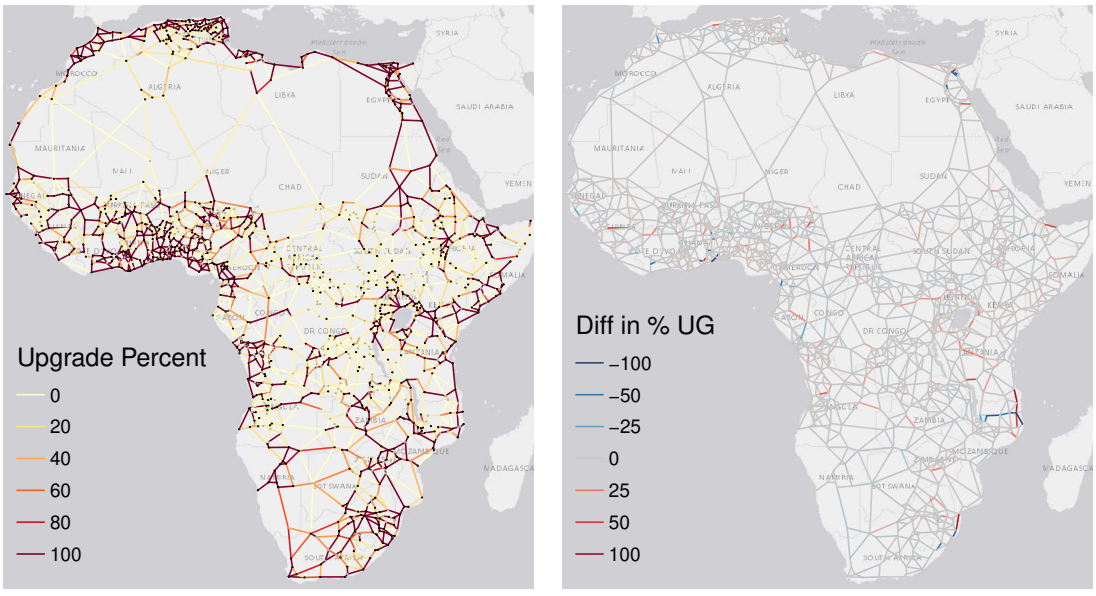


Figure A20: Ratio of Goods Flows under Border Frictions to Frictionless Flows: IRS Case

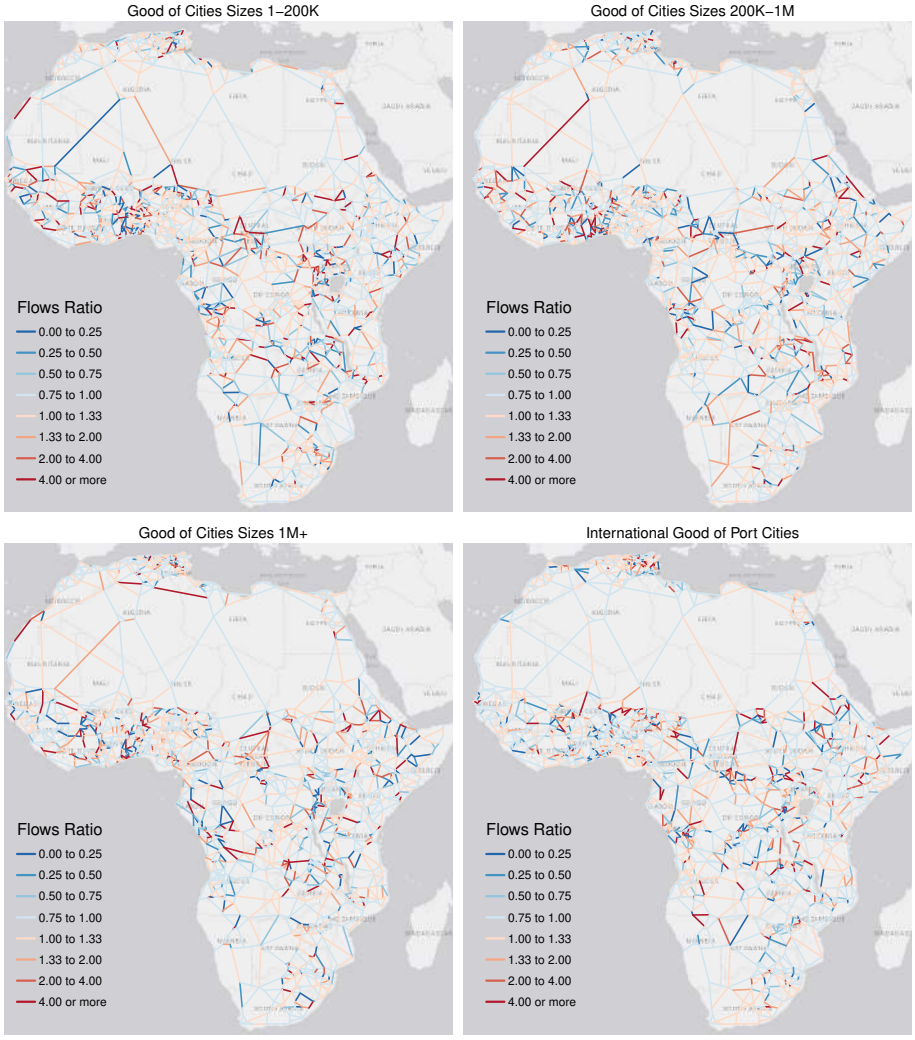


Figure A21: Trans-African Network Connecting Large Cities: Parameterization with Real Roads

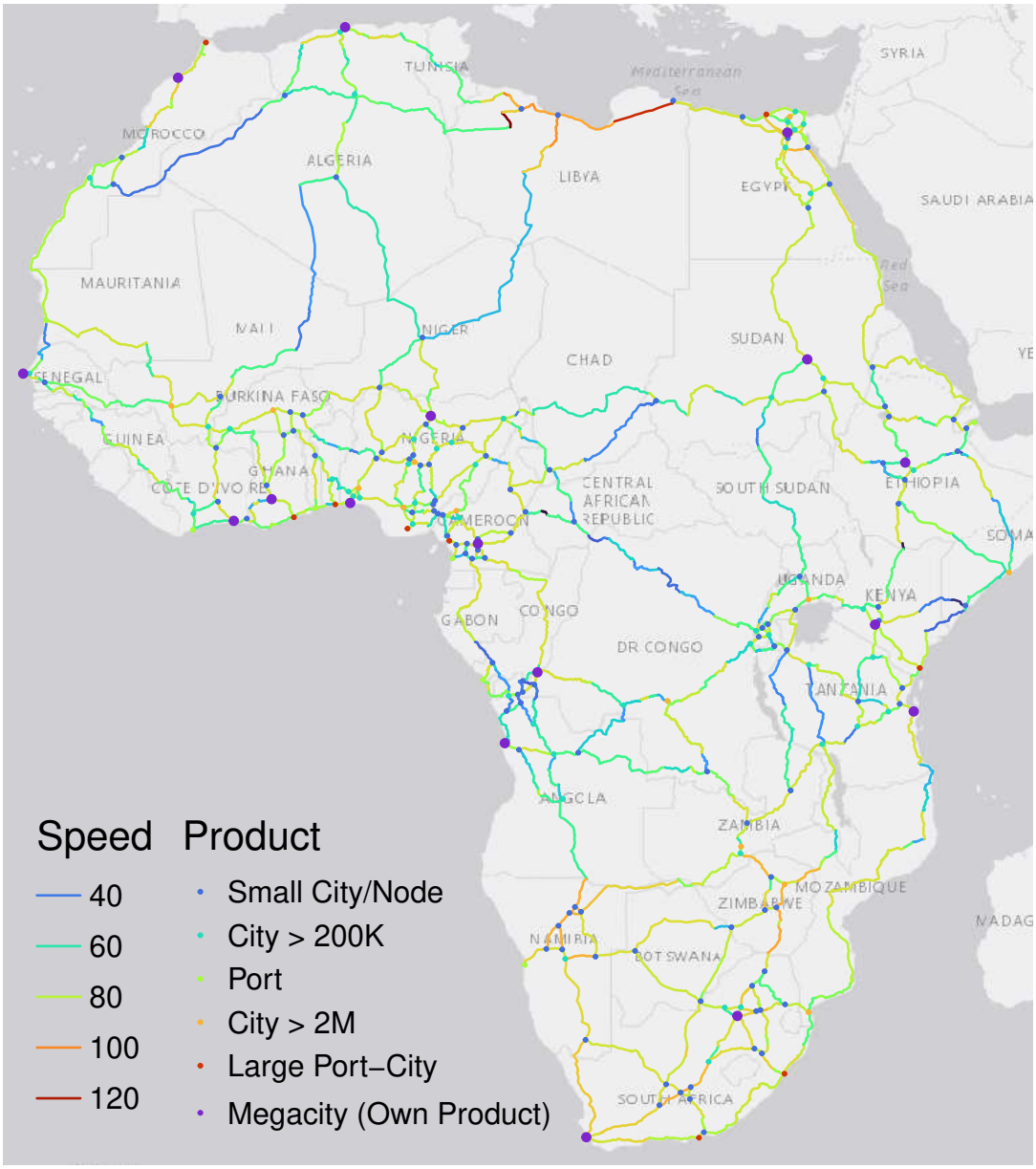


Figure A22: Flow of Goods Through Trans-African Network Connecting Large Cities

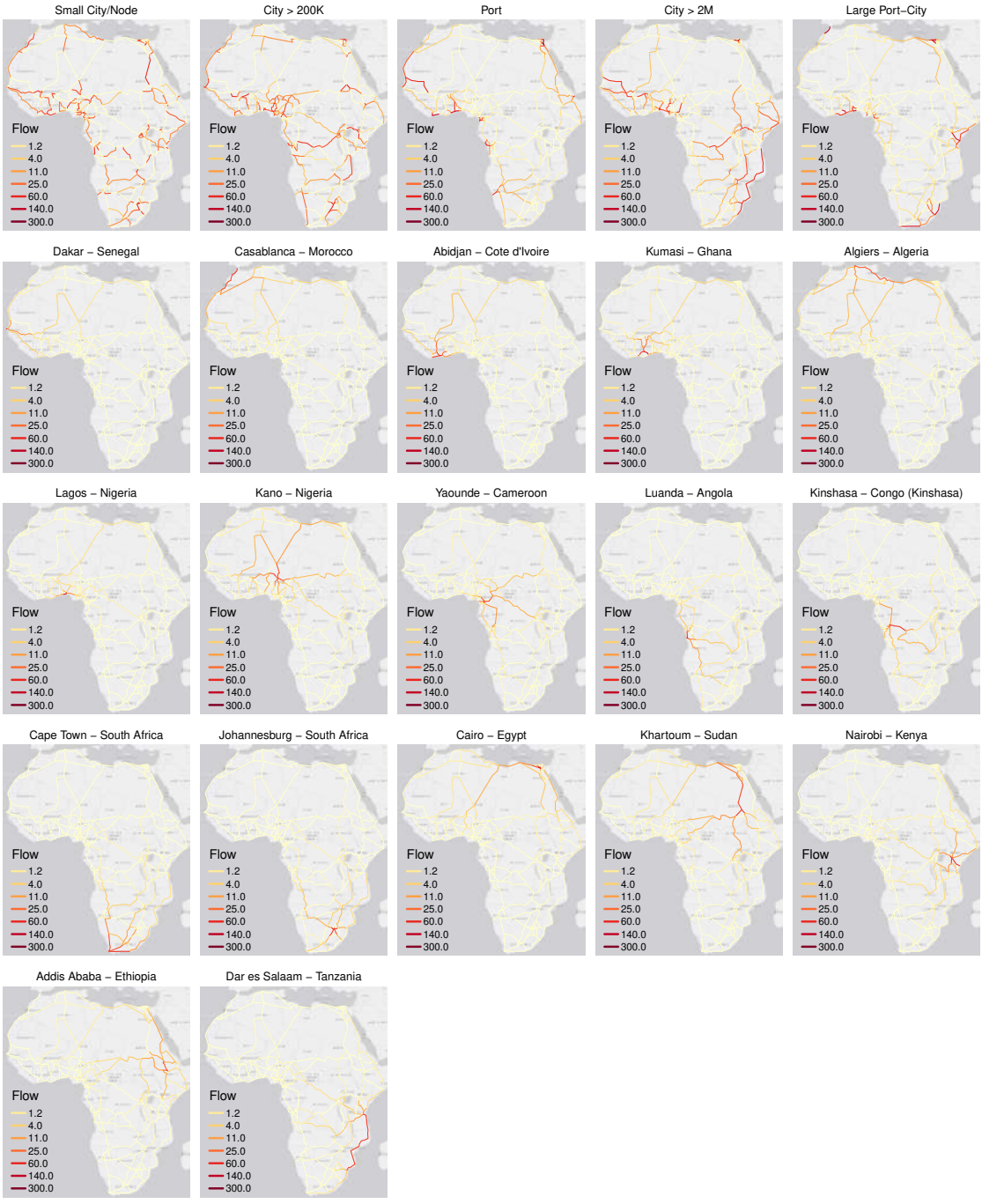


Figure A23: Optimal $10B Trans-African Investments and Trade by σ

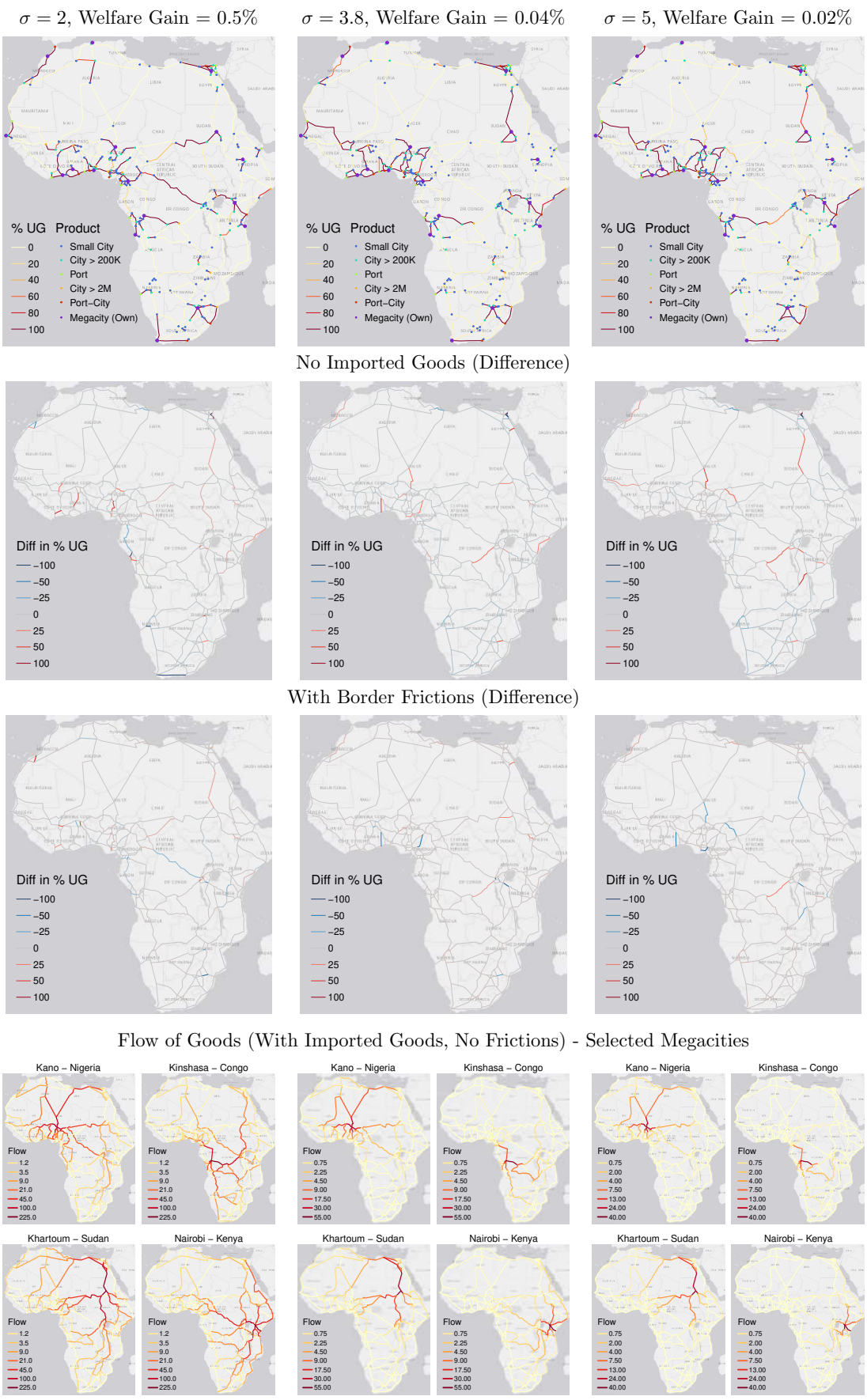


Figure A24: Optimal $10B Trans-African Investments by σ with Inequality Aversion ($\rho = 2$)

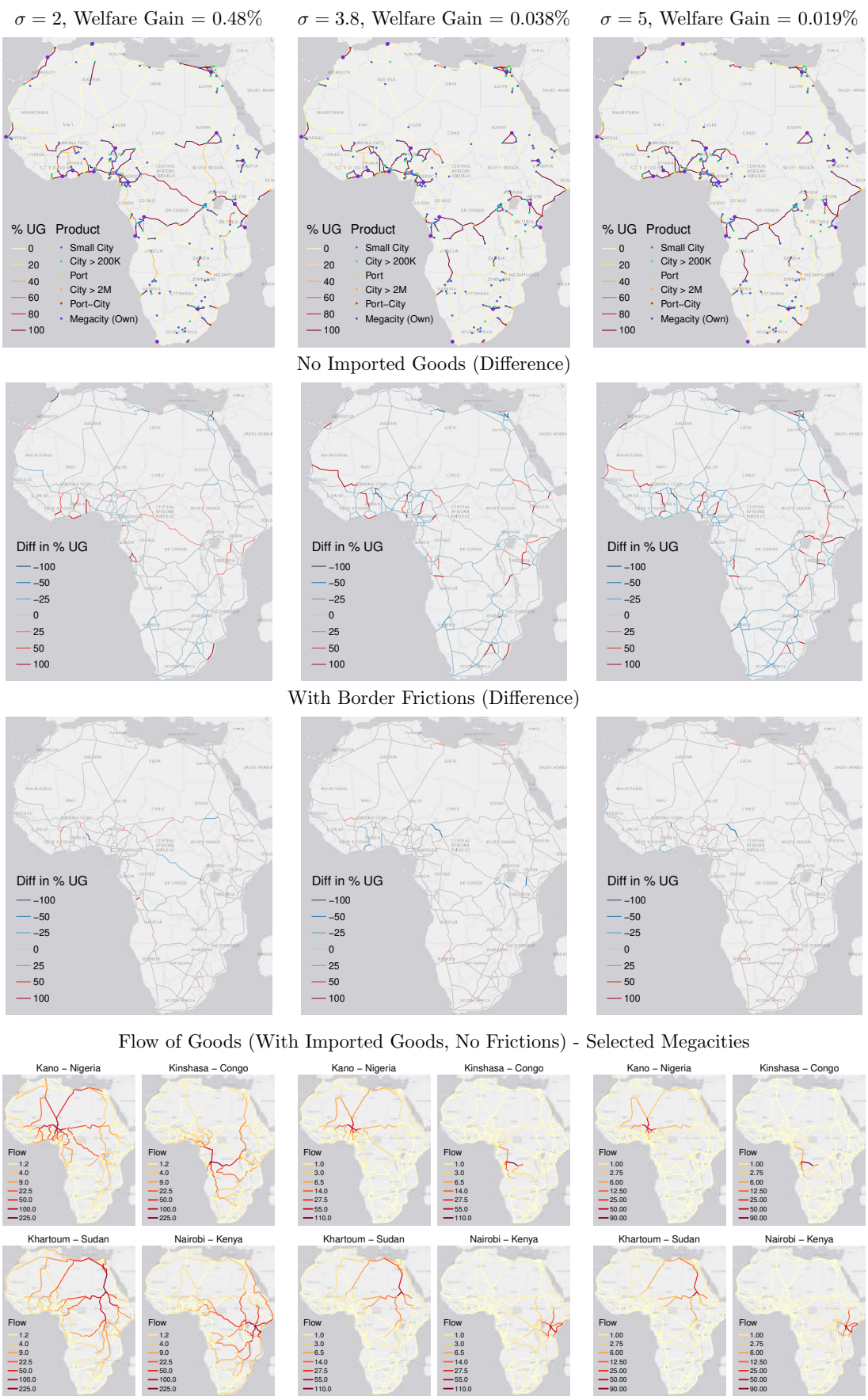


Figure A25: Flow of Goods Through Trans-African Network Connecting Large Cities: IRS Case

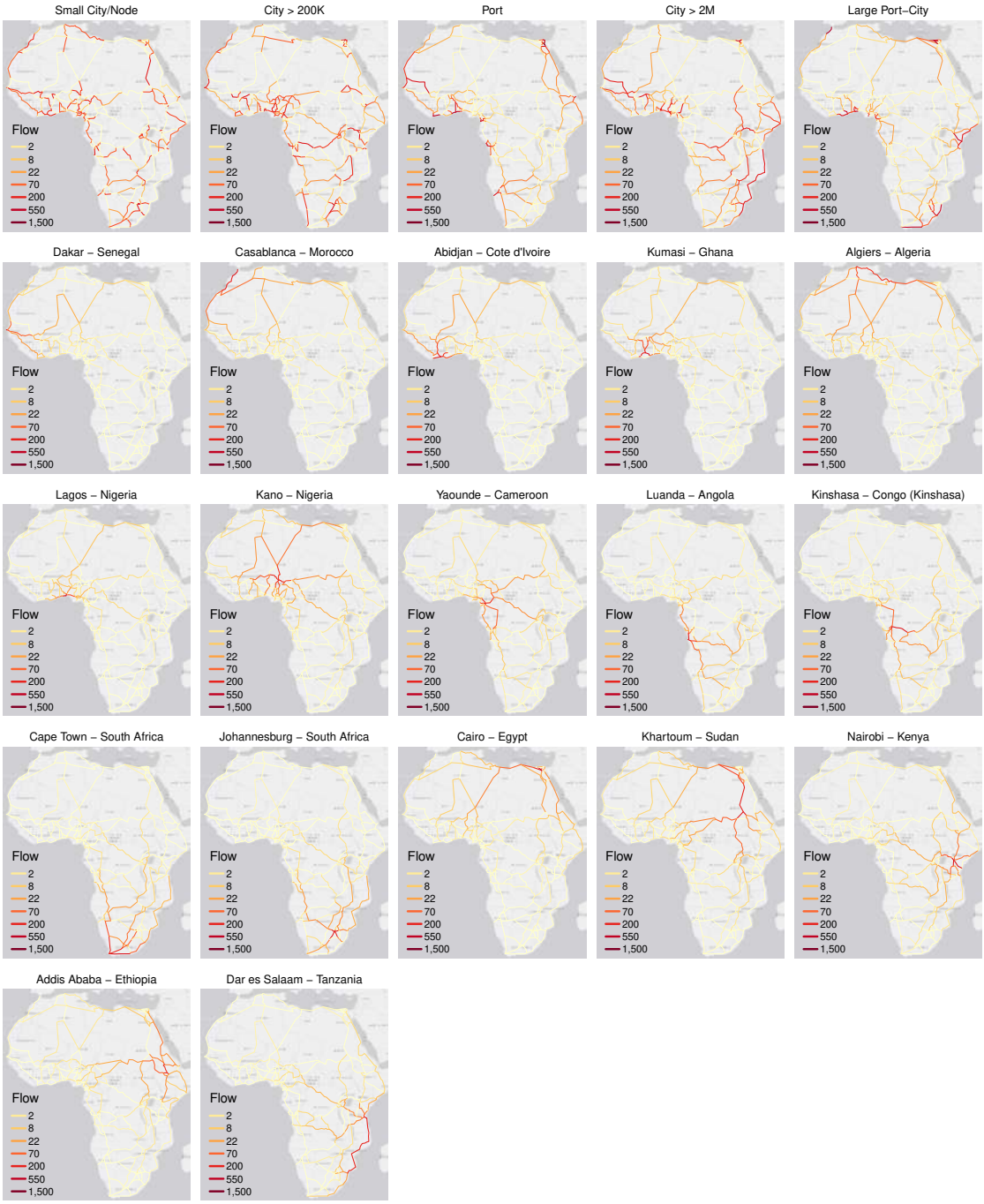


Figure A26: Optimal Trans-African Network Investments under Increasing Returns

Final Network Speed | Investments in km/h | Investments in % Completed

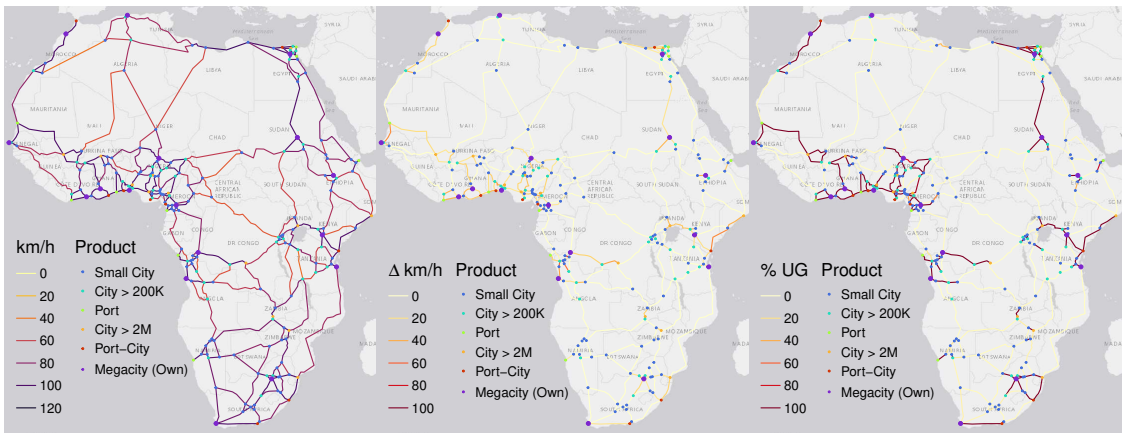


Figure A27: Optimal $10B Trans-African Investments and Trade by σ: IRS Case

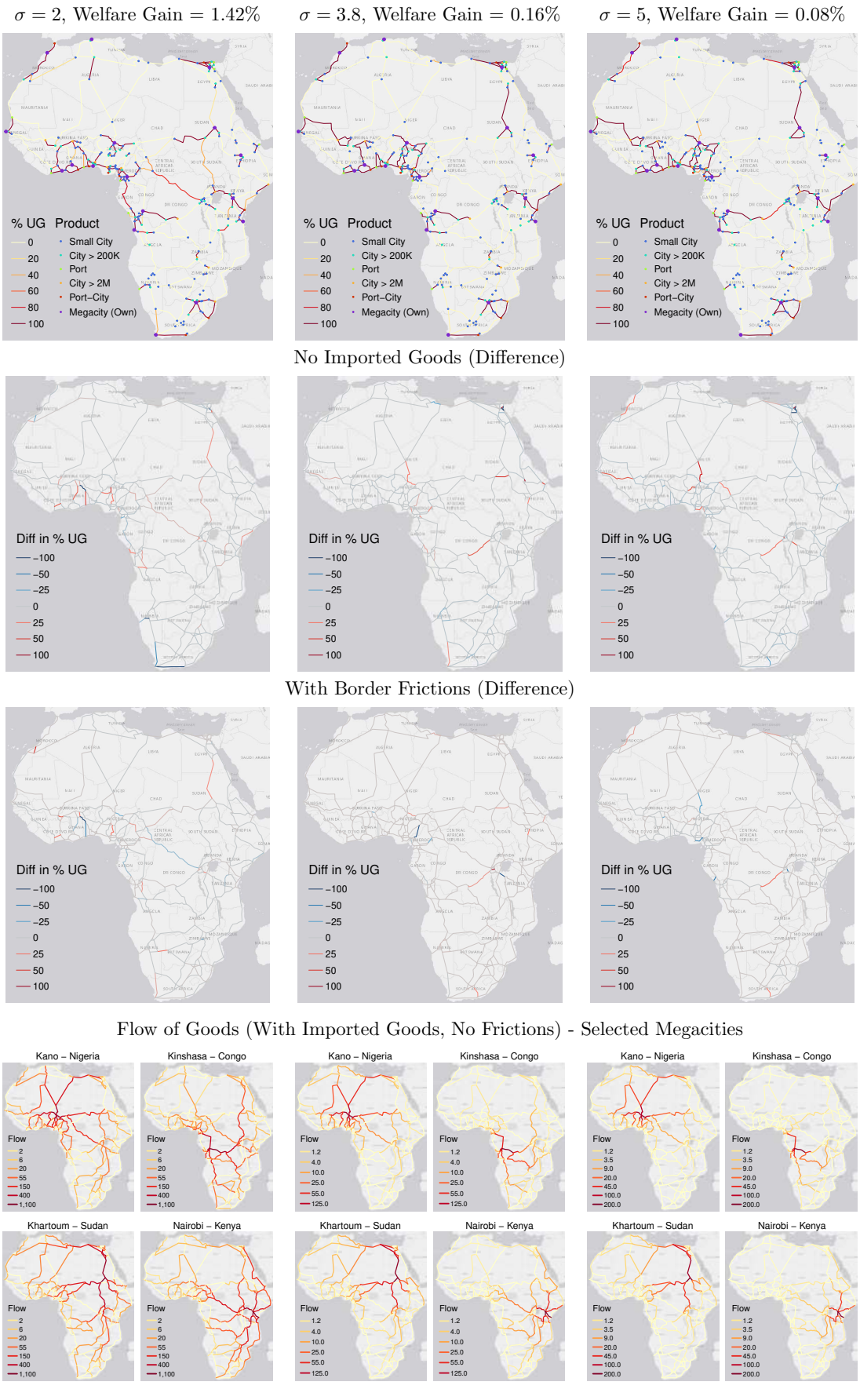


Figure A28: Optimal $10B Trans-African Investments by σ with Inequality Aversion ($\rho = 2$): IRS Case

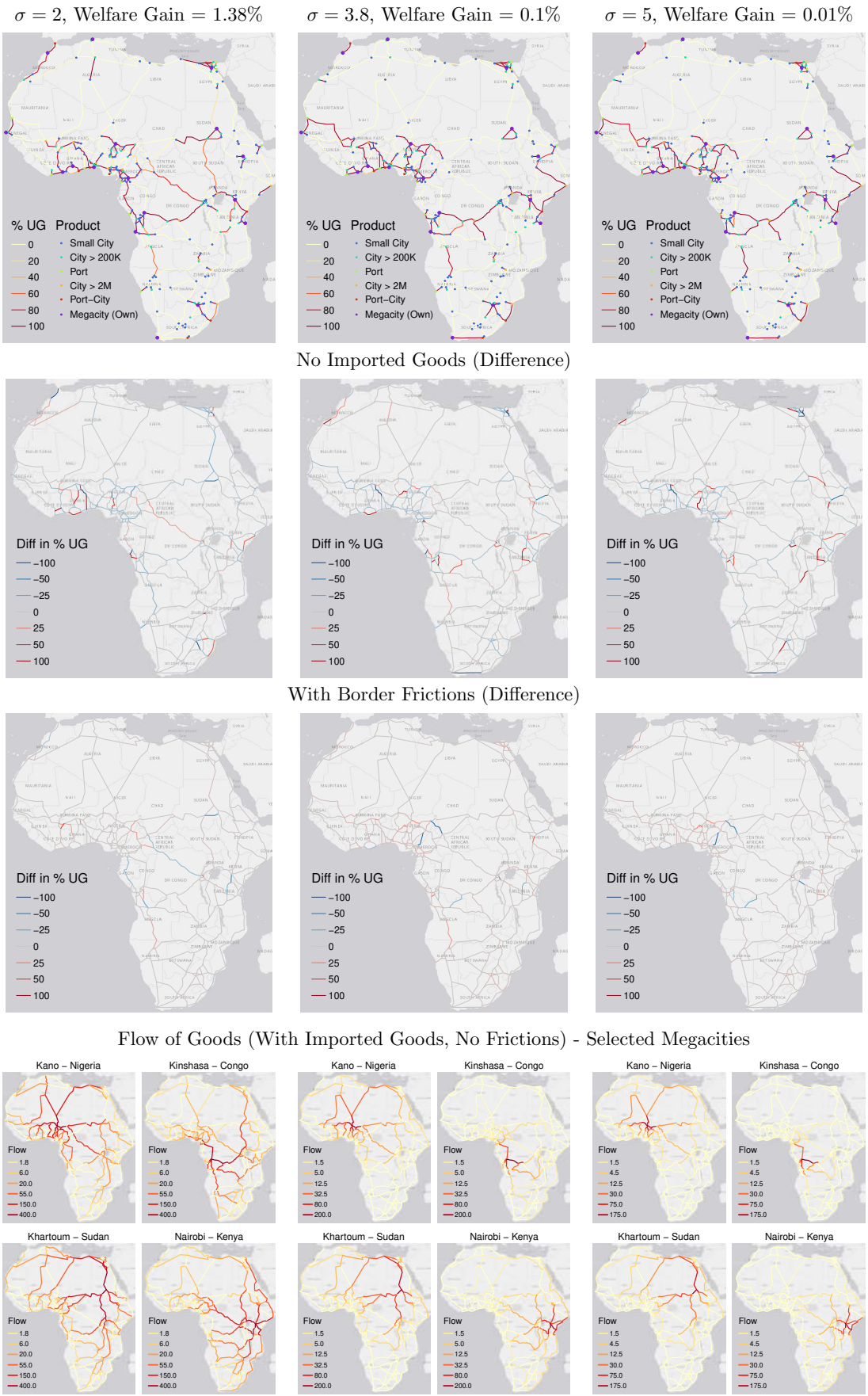


Figure A29: Flow of Goods Through Trans-African Network: Fastest and Shortest Routes

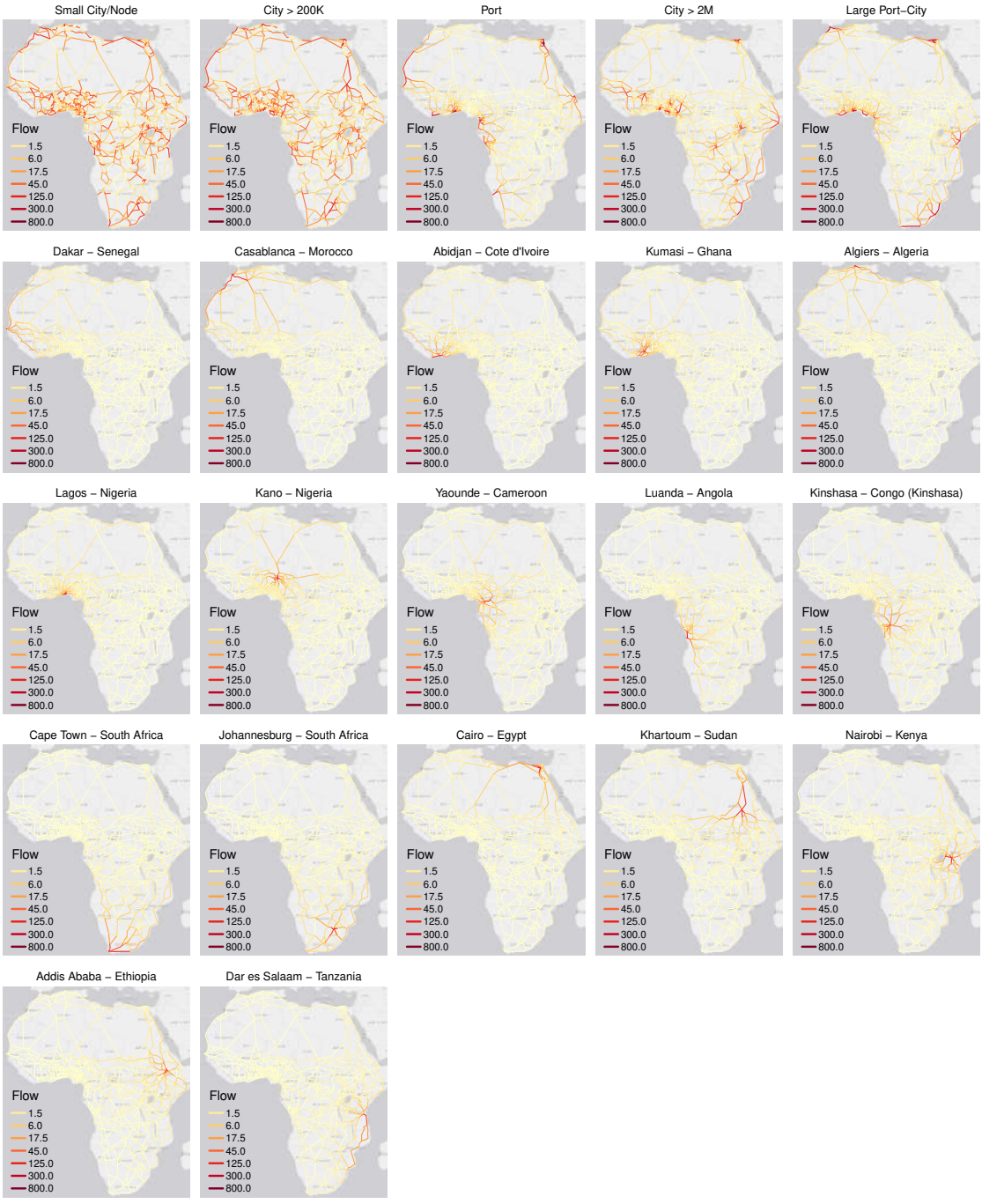
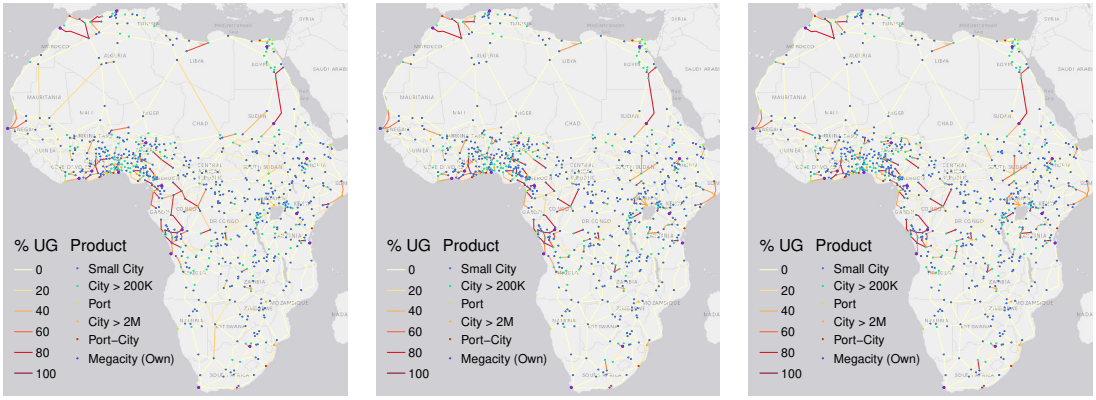
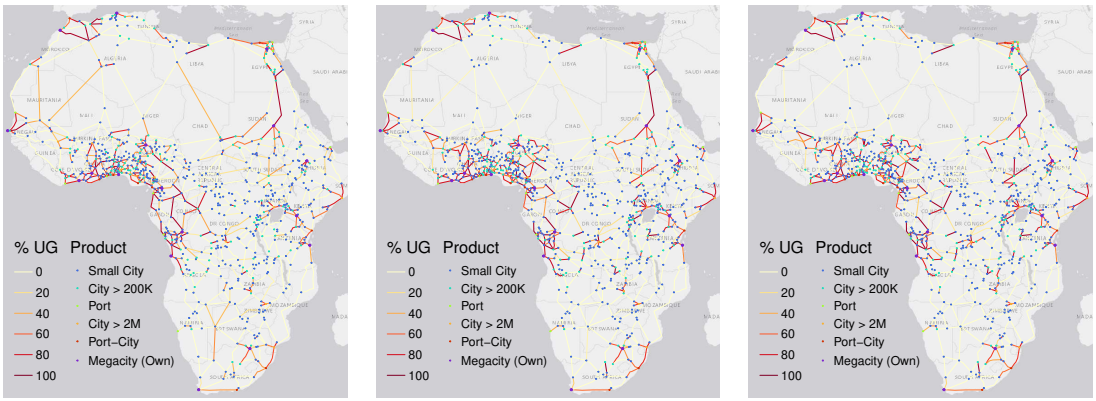


Figure A30: Optimal $10B and $20B Trans-African Investments by σ - Infrastructure

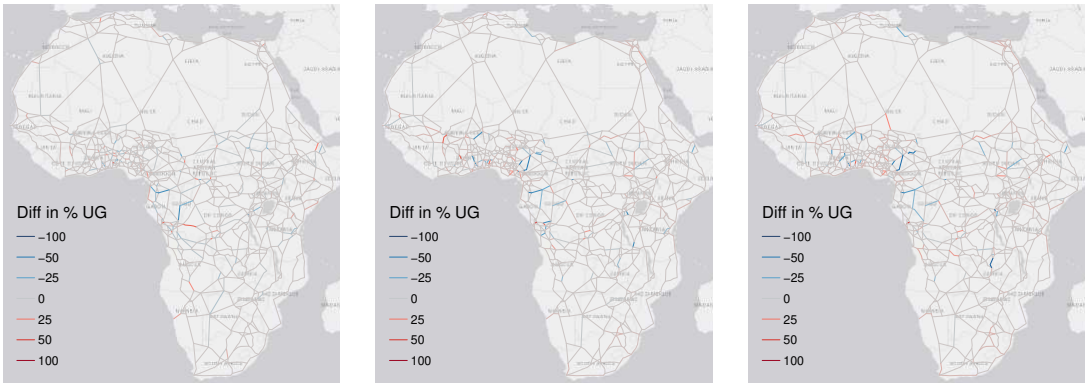
$\sigma = 2$ $\sigma = 3.8$ $\sigma = 5$



↑ $10B Budget | ↓ $20B Budget



Difference under Border Frictions ($20B Planner)



Flow of Goods (No Frictions, $20B Planner)

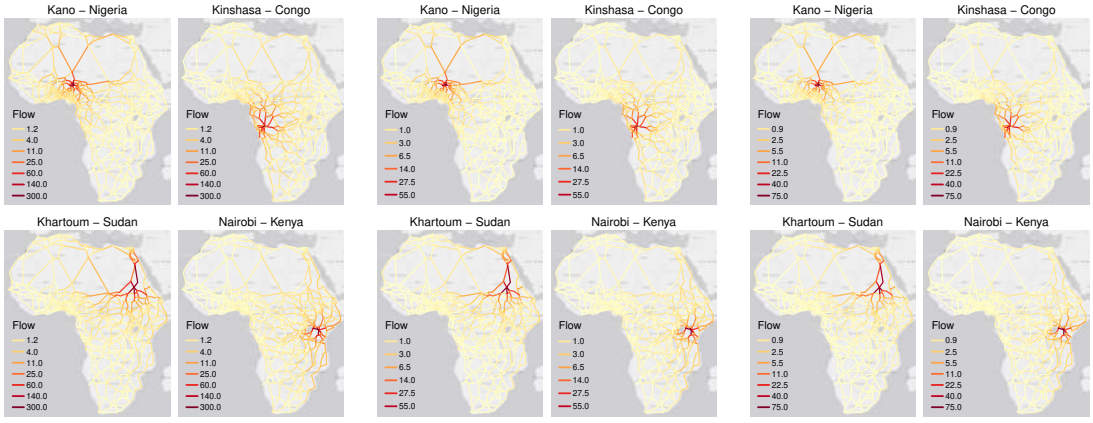


Figure A31: Welfare gains by σ: Standard and Frictions Scenarios

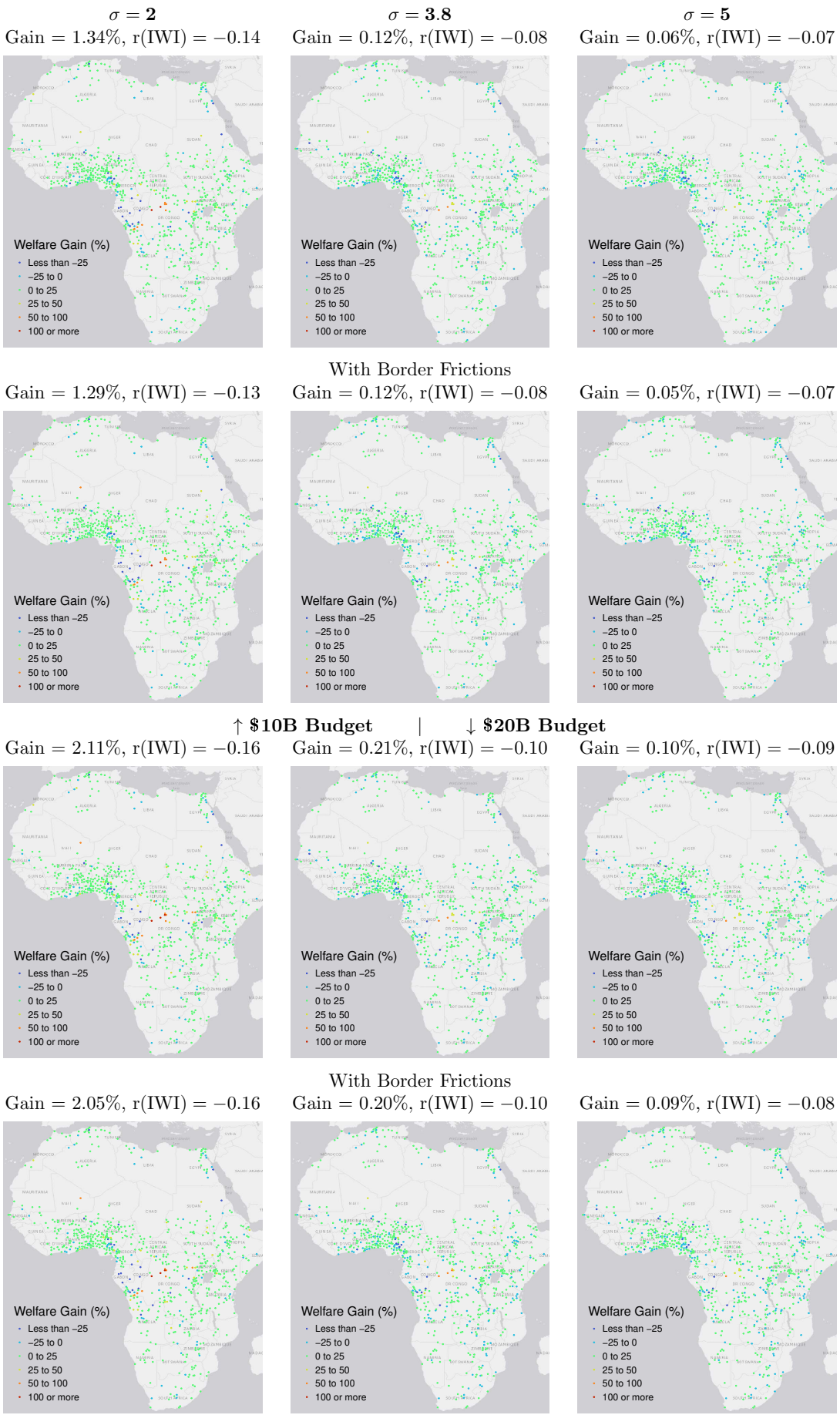
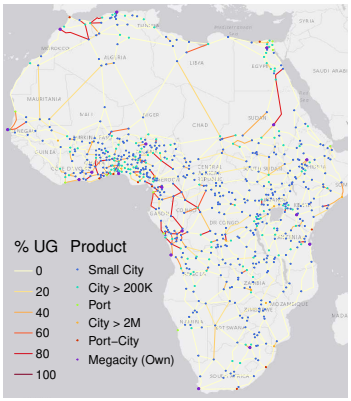
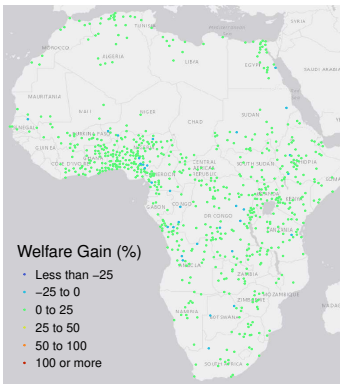


Figure A32: Optimal $10B Trans-African Investments & Welfare with Inequality Aversion by σ

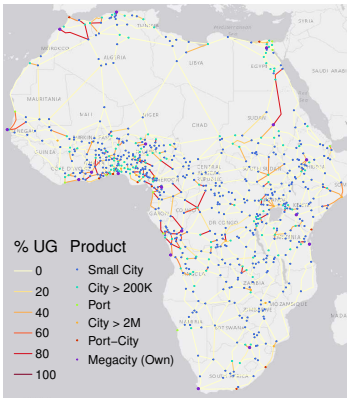
$\sigma = 2$, Completes 21,776km



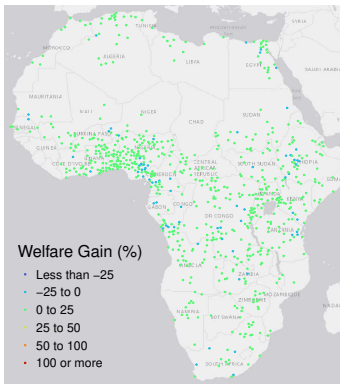
Gain = 1.2%, r(IWI) = −0.18



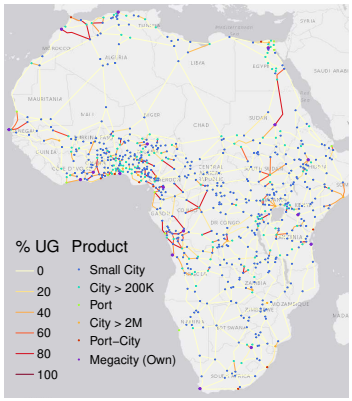
$\sigma = 3.8$, Completes 21,491km



Gain = 0.10%, r(IWI) = −0.07



$\sigma = 5$, Completes 21,427km



Gain = 0.04%, r(IWI) = −0.06

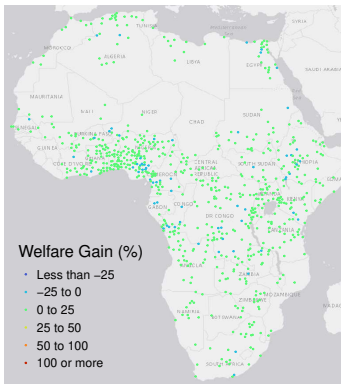
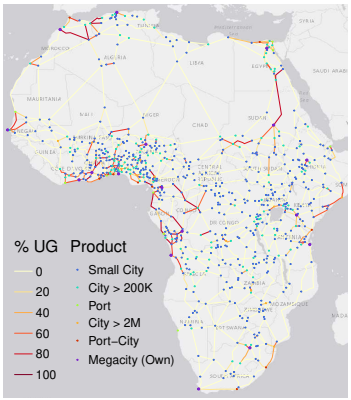
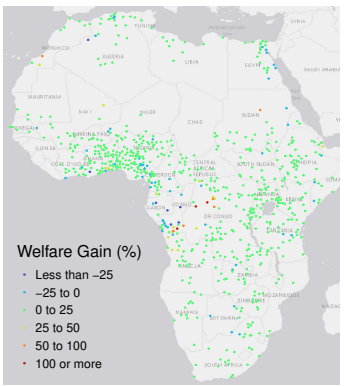


Figure A33: Optimal $10B Trans-African Investments & Welfare with Increasing Returns by σ

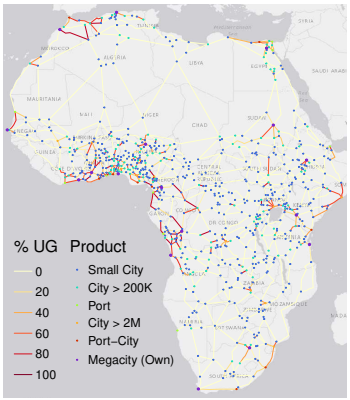
$\sigma = 2$, Completes 26,255km



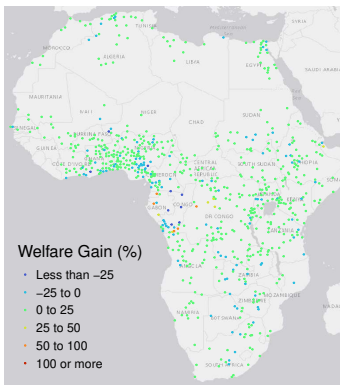
Gain = 3.5%, r(IWI) = −0.17



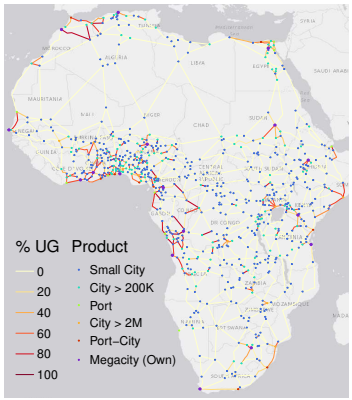
$\sigma = 3.8$, Completes 26,849km



Gain = 0.53%, r(IWI) = −0.13



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



Gain = 0.28%, r(IWI) = −0.11

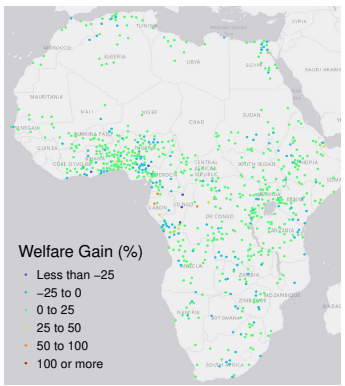
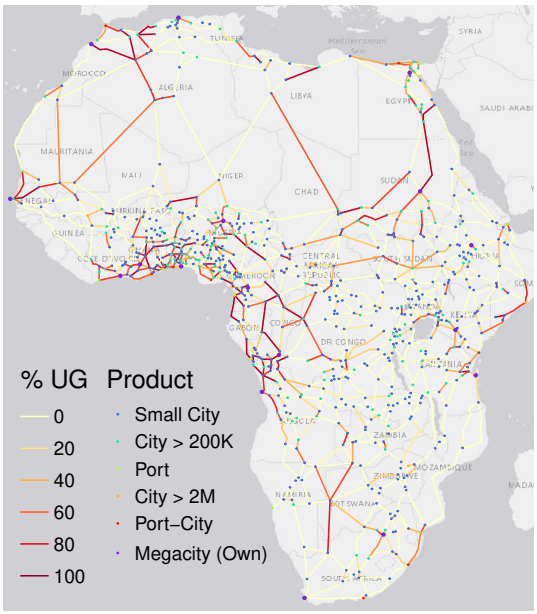
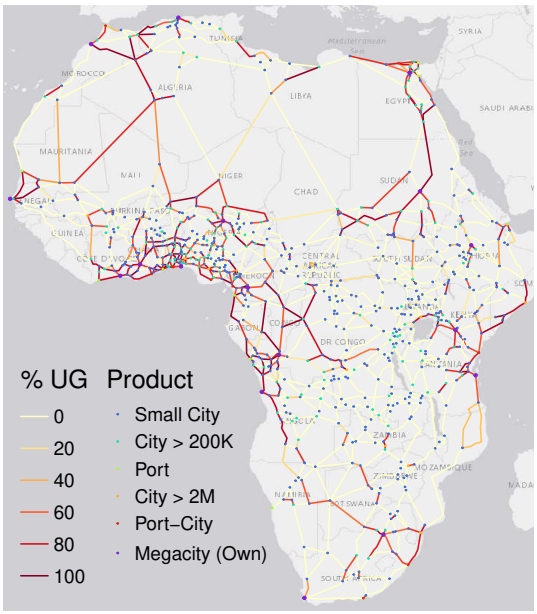


Figure A34: Optimal $20B Trans-African Network Investments on Large Network with $\sigma = 1.5$

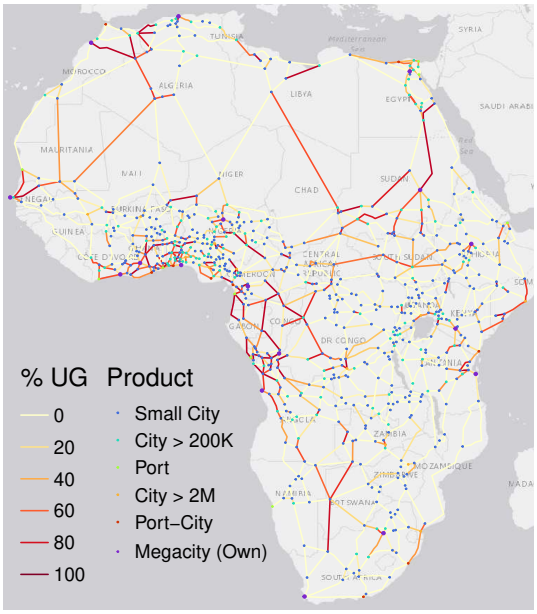
Standard Planner: Builds 49,729km



Increasing Returns Planner: Builds 61,290km



Inequality Averse Planner: Builds 48,370km



Inequality Averse IRS Planner: Builds 59,487km

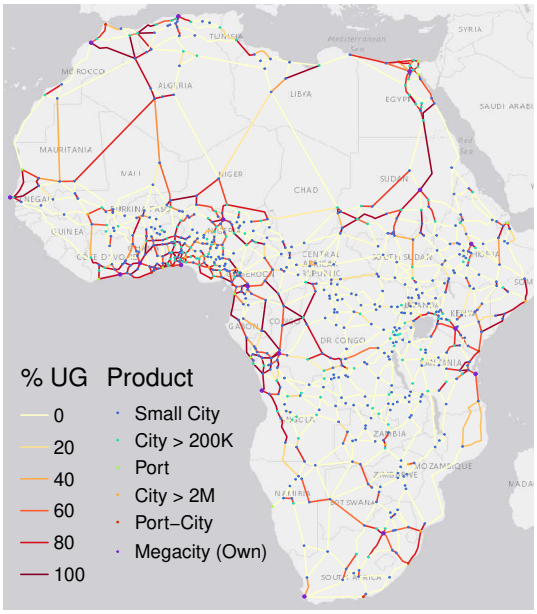
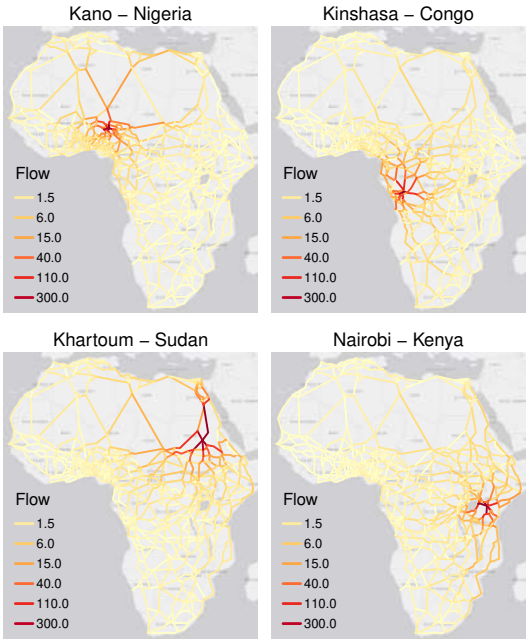


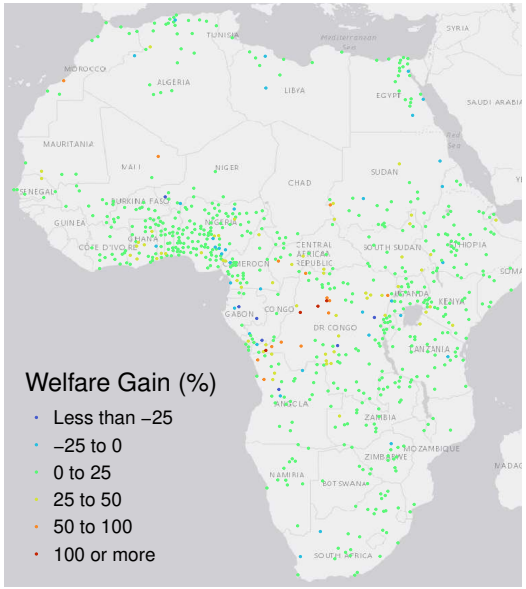
Figure A35: Optimal $20B Trans-African Flows & Welfare on Large Network with $\sigma = 1.5$

Standard Planner

Own Consumption Share: >96%

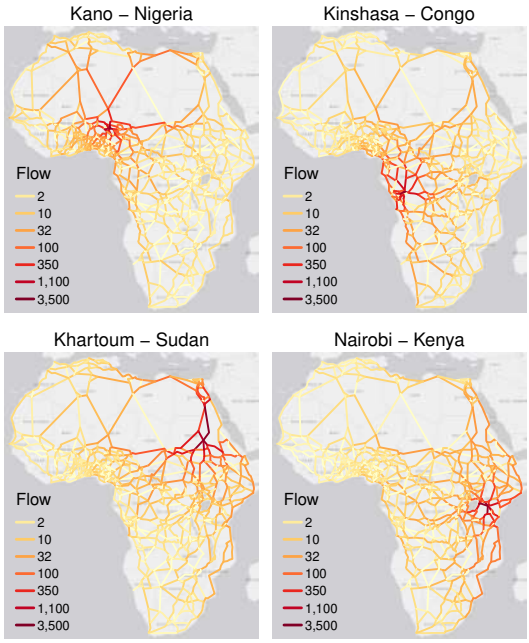


↑7.92% [p1: -22%, p50: 10%, p99: 80%, r: -0.24]



Increasing Returns Planner

Own Consumption Share: >78%



↑14.3% [p1: -5%, p50: 17%, p99: 84%, r: -0.25]