

Connectivity and its effects on interest rates and traded volumes in the Kenyan overnight interbank market

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- Interbank markets are important channel to de/stabilise financial markets.
- Long-standing relationships are beneficial, potentially reducing asymmetric information (Dong and Guo (2011), Yue et al. (2021))
- Network measures have been shown to affect interest rates and transaction volume (Finger and Lux (2017), Chiu et al. (2020))
- We want to combine both as different aspects of connectivity.
- Industrialised countries over-represented in studies; emerging markets under-represented
- Data availability biases this further towards industrialised countries;
- Study whether emerging may have different determinants.

Dataset I

- Unique dataset covering 16-06-2003 to 04-04-2012
- Identifies:
 - Source, target, volume, interest rate
 - Altogether 50 banks
- Bank characteristics:
 - Size (L, M, S),
 - Location of headquarters (F, L)
 - Ownership (L, P)

Size			Location			Ownership		
Label	#	%	Label	#	%	Label	#	%
Large	8	16	Foreign	18	36	Listed	16	32
Medium	15	30	Local	32	64	Private	34	68
Small	27	54						

- We identified 6 liquidity shocks during 2003-2012 (see table)
- We divide the entire sample period into three sub-samples: Pre-shock (16-06-2003 to 23-04-2006), Shock (24-04-2006 to 30-11-2009) and Post-shock (01-12-2009 to 04-04-2012)

Event D	Event	Event date
KGI	KenGen IPO	17/05/2006 (1st trading)
ELE	Post-election crisis	02/01/2008 (start)
SAI	Safaricom IPO	09/06/2008 (1st trading)
GFC	2007/8 Financial crisis	15/09/2008
KIB	Kengen Infrastructure Bond Issuance	02/11/2009 (issued)
KIB	Infrastructure Bond Issuance	07/12/2009 (issued); sale 12/02/2010 to 24/02/2010

- Data naturally forms a directed network
- Lender is the source, borrower is the target and link identifies liquidity flowing from the lender to the borrower

	All	Pre-shock	Shock	Post-shock
No days	2180	696	961	523
\bar{N}	34.98	30.88	38.18	34.64
N_{max}	42	40	42	41
N_{min}	2	7	30	2
\bar{E}	98.59	59.04	144.86	67.00
E_{max}	543	217	543	105
E_{min}	1	6	45	1

Significant Ties/Relationship Banking I

- We follow Kobayashi and Takaguchi (2018) to determine significant ties and relationship banking
- Model the "matching" probability between lender L and borrower B based on L and B 's real relative liquidity as expressed by their transactions

$$u_{i \rightarrow j}(a_i^{out}, a_j^{in}) = a_i^{out} a_j^{in}, \quad a_k \in [0, 1]$$

- $u_{i \rightarrow j}(\cdot)$ is the probability that i lends to j when i, j are indifferent to the identity of the partner
- Sign tie: L and B trade significantly (1% level) more often than the model predicts
- Sign tie always bound to a specific pair

Significant Ties/Relationship Banking II

- RB: A specific bank is engaged in RB if it has significantly fewer (1% level) partners than model predicts
- RB is specific for their roles, i.e. relationship lending/borrowing

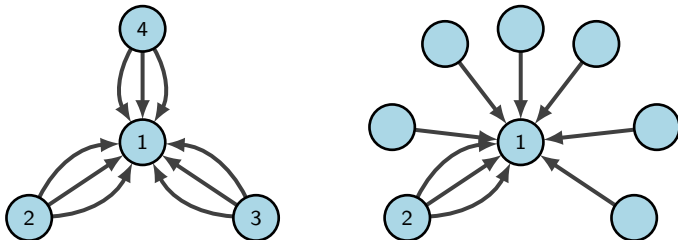


Figure: Relationship banking and significant ties

Significant Ties/Relationship Banking III

- ST and RB are calculated over a window of 12 consecutive trading days
 - I.e. ST and RB are dummy variables within the 12 day window
 - 12 day window was chosen to maximise stability of the network
 - Robustness was tested with different windows (6, 12, 18) and
 - Different significance levels (0.01, 0.05, 0.1)
 - We present results for 12 day window and significance level of 0.01
- Network measures are calculated over a network spanning the same 12 day window.

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- All network measures are widely used
- Measure "importance" of a bank in different ways
- Weighted in/out-degree centrality: volume of in/outgoing transactions to total transaction volume
 - Bank with highest weighted in-degree centrality borrowed the highest amount
 - H: positive effect on volume, potential negative effect on vwr

- In/out cluster coefficient: number of triangles in the neighbourhood to the number of possible triangles in the neighbourhood
 - Easier to access liquidity in clusters
 - H: positive effect on volume, negative on vwr

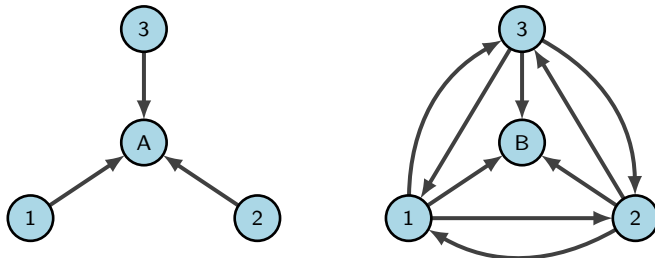


Figure: Low and high B-clustering coefficients

- (In/out) Katz centrality: Takes indirect connections into account (modified eigenvector centrality, weight 0.4)
 - Easier to access liquidity when connected to "important" firms
 - H: positive effect on volume, negative on vwr

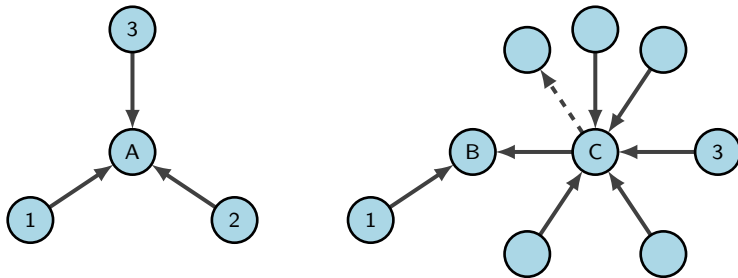
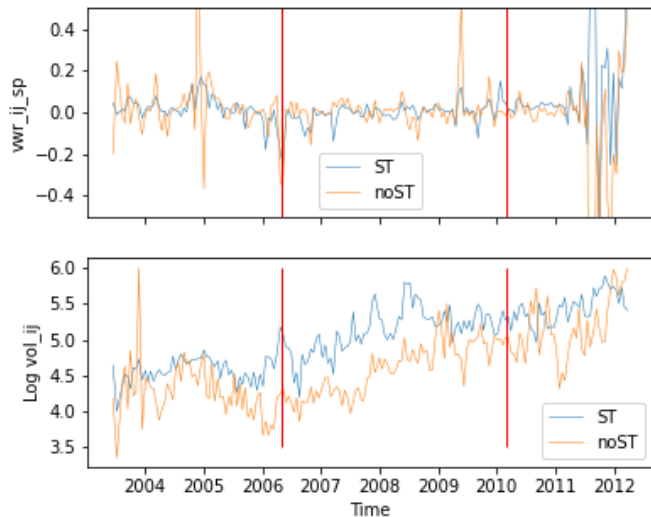
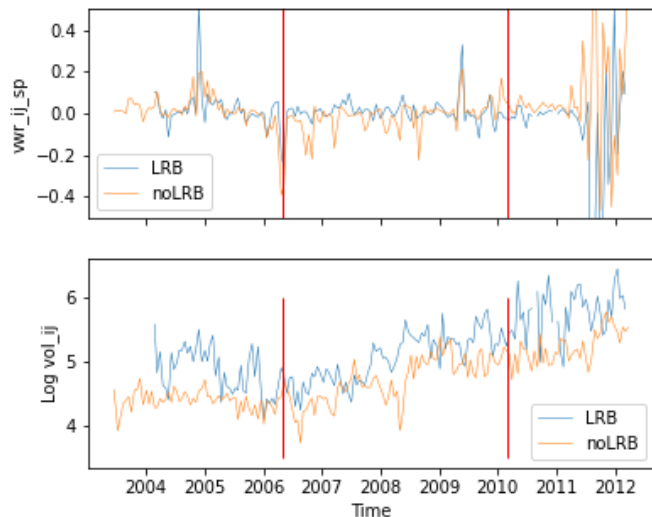


Figure: B-Katz centrality

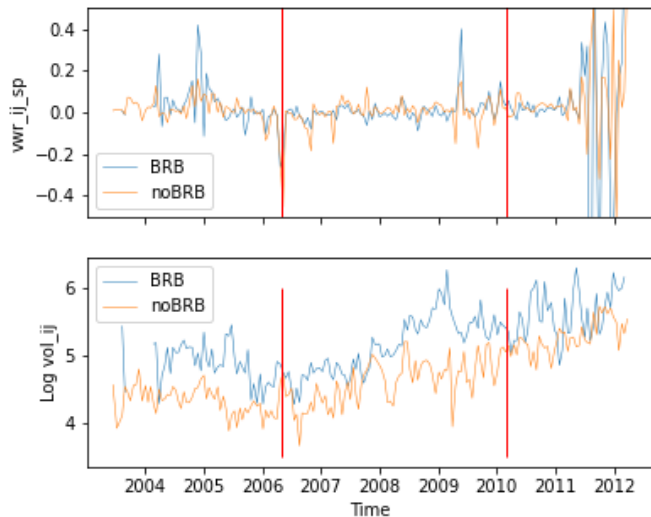
Significant Ties



Relationship Lending



Relationship Borrowing



- Graphs:
 - Consistent differences in bilateral volume between ST, LRB and BRB.
 - Potential period specific effects of ST, LRB and BRB on $\bar{r}_{ij,t}^s$
- Study effects of connectivity measures on bilateral interest rate (spread of bilateral vwr) and bilateral volume
- We use various measures connected to ST, RB and the network measures for lender and borrower separately as indicators of connectivity.
- We control for (lender/borrower) bank characteristics
- We control for the six liquidity shocks

- We employ random effects (panel) estimations
- We estimate the three periods separately
- Spread of volume weighted interest rate:

$$\bar{r}_{ij,t}^s = \beta_0 + \beta_1 B + \beta_2 C + \beta_3 BC + \beta_4 LS + \varepsilon$$

- Bilateral log volume:

$$\log w_{ij,t} = \delta_0 + \delta_1 B + \delta_2 C + \delta_3 BC + \delta_4 LS + \delta_5 M + \gamma$$

- B: bilateral measures; C: lender/borrower specific connectivity measures, BC: bank characteristics, LS: liquidity shocks, M: market

Results: Spread of Bilateral VWR I

	RE ALL (1)	RE pre (2)	RE shock (3)	RE post (4)
Const	-0.094***	0.059*	-0.186***	-0.591***
log $w_{ij,t}$	0.011***	0.0004	0.007***	0.036**
ST	-0.009	-0.049***	-0.015**	0.115**
ST Dur	0.004***	0.017***	-0.003***	0.024***
PR ST	0.424***	0.257***	0.385***	0.452***
L-numST	0.017**	0.021***	0.026***	-0.011
LRB	-0.042***	-0.043**	0.003	-0.180**
L-wdeg	0.222	-0.439***	-0.350***	1.003**
LBR:L-wdeg	-0.022	0.582***	0.056	0.563
L-cluster	-0.241***	-0.247**	0.038	-1.504**
LBR:L-cluster	0.372***	0.194	0.104**	1.825
B-numST	0.036***	0.006	-0.005	0.102***
BRB	-0.024	0.017	0.112***	0.110
B-wdeg	-0.490***	-0.041	0.044	-1.439**
BRB:B-wdeg	0.063	-0.188	-0.221***	1.088*
B-cluster	-0.121*	-0.172*	0.0003	1.151*
BRB:B-cluster	0.135*	-0.235	-0.227***	-6.427***
B-Katz	0.009	-0.053***	0.015**	-0.449
BRB:B-Katz	-0.004	0.017	-0.005	12.686**
B-type	-0.139***	-0.061***	0.094***	-0.208***
BRB:B-type	-0.019	0.019	-0.084***	-0.267***

Results: Spread of Bilateral VWR II

	RE ALL (1)	RE pre (2)	RE shock (3)	RE post (4)
Lsz:M	0.043***	-0.036*	-0.006	0.116*
Lsz:S	0.010	-0.111***	-0.030**	0.094
Bsz:M	0.074***	-0.006	0.025**	0.203***
Bsz:S	0.080***	0.048**	0.026**	0.220***
Bloc:L	0.021*	-0.021	0.004	0.108***
Lown:P	0.012	0.071***	0.006	0.051
KGI	-0.139***		-0.143***	
ELE	0.042*		0.056***	
SAI	0.058**		0.077***	
GFC	-0.083***		-0.049***	
KIB	-0.013		0.033***	
Observ	50,756	11,141	29,035	10,580
F Stat	15,970***	2,064***	6,460***	3,893***
Log-Lik	-65,662	-5,221	-11,908	-21,035
AIC	131,387	10,497	23,880	42,125
BIC	131,670	10,695	24,145	42,321
Within R ²	0.239	0.157	0.182	0.269

Note:

* p<0.1; ** p<0.05; *** p<0.01

Results: Spread of Bilateral VWR - Summary

- Subperiods are very different
 - Using entire sample and using dummies to get "period" effects is not justified
 - We use RE estimation for each sub-period separately.
- RB and network measures have predominantly negative effect on VWR
- Interaction terms are mostly positive for lenders and negative for borrowers
 - better connected lenders/borrowers engaging in RB get more favourable rates
- Post-shock period seems different in many respects.
- Some support for the notion that bank characteristics matter and are changing across the sub-periods
 - We observed this before.

Results: Bilateral Volume I

	RE ALL (1)	RE pre (2)	RE shock (3)	RE post (4)
Const	-2.155***	-0.053	-2.798***	3.365***
log w_t	0.469***	0.284***	0.458***	0.093**
\bar{r}_t	0.009***	-0.013***	-0.046***	0.012***
$\bar{r}_{ij,t}^S$	0.010**	-0.007	0.079***	0.003
ST	0.675***	0.492***	0.863***	0.349***
ST Dur	0.016***	0.037***	0.015***	0.020***
L-numST	0.028***	-0.025	0.056***	0.058***
LRB	0.510***	0.581***	0.660***	0.501***
L-wdeg	10.443***	11.503***	12.411***	4.176***
LBR:L-wdeg	-1.537***	-3.045***	-1.610***	-0.957***
L-cluster	-0.942***	0.306	0.052	0.437
LBR:L-cluster	-0.593***	-1.981***	-0.862***	-0.523
L-Katz	0.032*	0.119***	-0.014	5.508***
LBR:L-Katz	-0.029	-0.109**	0.019	-1.867***
L-type	-0.218***	-0.099***	-0.116***	-0.221***
LBR:L-type	0.008	0.026	0.007	0.110***
B-numST	0.164***	0.215***	0.195***	0.110***
BRB	0.281***	0.285***	0.394***	0.448***
B-wdeg	5.915***	5.564***	5.257***	5.588***
BRB:wdeg	-0.349**	-0.877**	0.872***	-1.258***
B-cluster	-0.745***	0.405*	-0.197**	-0.308
BRB:B-cluster	0.184*	-0.574	-0.017	-2.658***
B-Katz	0.006	-0.019	0.009	-5.820***
B-type	-0.190***	-0.147***	-0.078	-0.072***
BRB:B-type	0.152***	0.207***	0.157**	0.019

Results: Bilateral Volume II

	RE ALL (1)	RE pre (2)	RE shock (3)	RE post (4)
Lsz:M	-0.014	-0.121**	0.072	-0.410***
Lsz:S	-0.182***	-0.207***	-0.045	-0.814***
Bsz:M	-0.142***	-0.265***	-0.173***	-0.148***
Bsz:S	-0.439***	-0.452***	-0.441***	-0.620***
Lloc:L	-0.024	-0.109**	0.060	-0.116***
Bown:P	0.125***	0.137***	0.153***	-0.101**
KGI	-0.097***		0.088**	
ELE	0.061**		0.079**	
SAI	-0.133***		-0.042	
GFC	0.007		0.045	
KIB	0.057**		0.167***	
Observations	50,756	11,141	29,035	10,580
F Statistic	24,242***	5,602***	13,944***	6,449***
Log-Likelihood	-74,358	-14,800	-43,448	-12,487
AIC	148,787	29,662	86,967	25,037
BIC	149,105	29,889	87,265	25,262
Within R-squared	0.381	0.424	0.358	0.473

Note:

* p<0.1; ** p<0.05; *** p<0.01

Results: Bilateral Volume - Summary

- A more coherent picture across the three sub-periods
- Bilateral vol higher when ST
- Relationship lending/borrowing leads to higher transaction vol.
- Katz/weighted degree centrality leads to higher transaction vol, not clustering
- Interaction terms are mostly negative.

Thank you

Thank you.

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