

Table 1: Variables and their notations and explanation

Variables (Notations)	Definitions	Sources
Output (Y)	i. Total Assets (Y1) ii. Working Assets (Y2) iii. Sum of Deposits and non-bank Loans (Y3) iv. Non-Bank Loans (Y4) v. Earning Assets (Y5)	Koetter and Noth (2013); Martin-Oliver and Salas-Fumas (2008)
Data Analytics (DA)	DA is a dummy variable, '1' for banks that have invested in DA and '0' otherwise.	Muller <i>et al.</i> (2018)
Capital (K)	Fixed Assets less depreciation	Koetter and Noth (2013)
Employees (L)	Number of full-time employees in the banks	Brynjolfsson and McElheran, (2019); Koetter and Noth (2013);
Dynamic Capabilities (DC)	R&D expense is taken as a proxy for dynamic capabilities and measured through training expense.	Hsu & Wang (2012)
Information Technology expense (ITE)	Dummy variable, '1' for the banks that report IT expense and '0' otherwise	Brynjolfsson and McElheran, (2019)
Age of investment in data analytics (DA-Age)	Age of the investment in data analytics in years	Brynjolfsson <i>et al.</i> (2011)
Deposits (Deposits)	The sum of all types of deposits such as current deposits, savings deposits, and time deposits as a ratio to total assets	Coulibaly (2020)
Non-Performing Loans (NPL)	Non-performing loans taken as a ratio to total loans	Kotter and Noth (2013)
Type (Type)	Dummy variable, 1 for the commercial banks and '0' for microfinance banks	Gul & Ellahi (2021)
Listing (LIST)	Dummy variable, '1' for the banks listed on Pakistan Stock exchange and '0' otherwise.	Ehsan and Javid (2018)
GDP growth (GDP G)	The growth rate of annual GDP	Ehsan and Javid (2018)
Inflation rate (Inf)	The annual log difference of the consumer price index (CPI) is the inflation rate	Ehsan and Javid (2018)
Age (Age)	Log of the age of a bank as a proxy for the size of banks	Brynjolfsson and McElheran (2019)

Table 2: Descriptive Statistics

Variables	Obs	Mean	Std.	Min	Max
Log(Y1)	336	7.9906	0.9517	5.0438	9.4948
Log(Y2)	336	7.9778	0.9567	5.0417	9.4872
Log(Y3)	336	8.0203	1.0920	3.7794	9.5371
Log(Y4)	336	7.6044	1.0879	2.5465	9.0612
Log(Y5)	336	7.8630	1.0366	3.7308	9.4134
DA	336	0.2857	0.4524	0	1
K	336	6.0064	1.9277	4.1341	7.8782
L	336	3.3872	0.5840	1.3010	4.3245
ITE	306	4.7639	0.8921	2.3720	7.3570
DC	228	4.1703	0.7680	1.6335	5.5834

Table 3: Correlation Matrix

	Log(Y1)	Log(Y2)	Log(Y3)	Log(Y4)	Log(Y5)	DA	K
Log(Y1)	1						
Log(Y2)	0.9999*	1					
Log(Y3)	0.9833*	0.9832*	1				
Log(Y4)	0.9616*	0.9616*	0.9868*	1			
Log(Y5)	0.9894*	0.9893*	0.9877*	0.9691*	1		
DA	0.1930*	0.1903*	0.1812*	0.1833*	0.1980*	1	
K	0.4155*	0.4119*	0.3973*	0.3882*	0.4431*		1
L	0.9087*	0.9077*	0.9121*	0.9068*	0.9013*	0.1838*	0.3997*
ITE	0.7367*	0.7339*	0.7324*	0.7210*	0.7337*	0.4986*	0.3764*

Note: *p<0.05

Table 4: Impact of DA on banks' output

	Log(Y1)	Log(Y2)	Log(Y3)	Log(Y4)	Log(Y5)
logY (-1)	0.409 (0.2943)	0.414 (0.2801)	0.368*** (0.1393)	0.514*** (0.0897)	0.497*** (0.1274)
DA	0.0181* (0.0595)	0.0102 (0.05814)	0.1247** (0.0603)	0.1339* (0.0710)	0.0207* (0.0761)
Log(K)	0.3904 (0.2041)	0.1728 (0.1999)	0.1475 (0.1210)	0.0450 (0.0959)	0.0833 (0.1226)
Log(L)	0.5059*** (0.1738)	0.5376*** (0.1736)	0.4476*** (0.1253)	0.3826*** (0.1280)	0.3646* (0.2188)
Deposits	-0.1335 (0.1583)	-0.1430 (0.1766)	0.5228*** (0.1728)	0.3281* (0.1878)	0.1372 (0.2257)
CAR	-0.4226 (0.1729)	-0.4574* (0.1795)	-0.3571* (0.1913)	-0.2087 (0.2388)	-0.642* (0.2820)
NPL	-0.28110 (0.2606)	-0.3232 (0.2642)	-0.3218 (0.2127)	-0.2500 (0.2692)	-0.3077 (0.4371)
Z-score	-0.0004 (0.0013)	-0.0007 (0.0015)	0.0025 (0.0034)	0.0019 (0.0036)	0.0030 (0.0039)
LIST	-0.0268 (0.0748)	-0.0257 (0.0840)	0.0077 (0.0636)	-0.0368 (0.1011)	-0.21402 (0.1362)
TYPE	0.2836 (0.2062)	0.3000 (0.1991)	0.3276*** (0.0884)	0.2635*** (0.0764)	0.4643*** (0.1700)
INF	-0.879*** (0.0128)	-0.9276* (0.1298)	-0.6673* (0.0956)	-0.5364 (0.4062)	-0.8319 (0.5288)
GDP_g	-0.0016 (0.0739)	-0.0034 (0.0757)	0.0404 (0.0608)	0.0817 (0.0694)	-0.0731 (0.0771)
No. of Obs.	297	297	297	297	297
GMM style	Y(-1)	Y(-1)	Y(-1)	Y(-1)	Y(-1)
Arellano- Bond test for AR(1)	0.083 0.994	0.0810 0.987	0.128 0.526	0.095 0.883	0.253 0.286
Hansen over identification	0.268	0.246	0.232	0.402	0.198
Hansen GMM	0.268	0.966	0.341	0.524	0.721
Hansen IV instruments	0.668	0.863	0.547	0.170	0.985

Notes: Hansen: Test: Ho: over identifying restrictions are valid. H0: Restrictions of over identification are valid. Serial Correlation Test: errors in first difference regressions do not exhibit second order serial correlation, value in parenthesis is p-value of Arellano Bond test for AR(1) and AR(2). Hansen GMM instruments: H0: instruments are endogenous: the given values are p-values. Hansen IV: H0: instruments are endogenous. The given values are p-values.

Table 5: Impact of DA on banks' output with Dynamic Capabilities

	Log(Y1)	Log(Y2)	Log(Y3)	Log(Y4)	Log(Y5)
Y (-1)	-0.054 (0.222)	0.391 (0.268)	0.357 (0.138)	0.527*** (0.0851)	0.50*** (0.109)
DA	0.027 (0.058)	0.064 (0.077)	0.1290* (0.0642)	0.139** (0.061)	0.029** (0.175)
DA*DC	0.020 (0.068)	-0.028 (0.0202)	0.0160 (0.0384)	-0.011 (0.027)	0.032 (0.050)
Log(K)	0.367*** (0.107)	0.124 (0.173)	0.1674 (0.113)	0.031 (0.091)	0.113 (0.126)
Log(L)	0.830*** (0.302)	0.665*** (0.183)	0.434*** (0.134)	0.389*** (0.118)	0.314 (0.237)
No. of Obs.	192	192	192	192	192
GMM style instruments	Y(-1)	Y(-1)	Y(-1)	Y(-1)	Y(-1)
Arellano-Bond test for AR(2) in first differences (z:	0.075 (0.81)	0.018 (0.798)	0.118 (0.598)	0.1000 (0.780)	0.252 (0.310)
Hansen over identification	0.350	0.324	0.219	0.323	0.151
Hansen GMM Instruments	0.980	0.543	0.420	0.675	0.702
Hansen IV instruments	0.898	0.576	0.797	0.216	0.874

Notes: Hansen: Test: Ho: over identifying restrictions are valid. H0: Restrictions of over identification are valid. Serial Correlation Test: errors in first difference regressions do not exhibit second order serial correlation, value in parenthesis is p-value of Arellano Bond test for AR(1) and AR(2). Hansen GMM instruments: H0: instruments are endogenous: the given values are p-values. Hansen IV: H0: instruments are endogenous. The given values are p-values.