Exploring the Economic Effects of Financial Development Across Sub-Saharan African Nations

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Abstract

The study on the financial development and economic performance of Sub-Saharan Africa utilizes correlation mean deference and standard deviation to investigate the influence of Financial development and regional economic performance. The research findings reveal significant impacts of various financial indicators on economic growth, such as the positive influence of bank liquid reserves on bank assets ratio (R/A), trade openness, and the broad money to total reserves ratio (M/R) on the economic growth of Sub-Saharan Africa. Additionally, the study highlights the negative impact of Credit extended to the private sector by banks within the country (D_bank) on economic development, emphasizing the importance of prudent credit allocation to avoid over-indebtedness and financial crises. These results provide valuable insights for policymakers aiming to foster sustainable economic growth in the region by leveraging financial development effectively.

Key Words: Financial development, Economic performance, Sub-Saharan Africa, theoretical review

Introduction

Financial development is crucial in influencing economic growth across different countries in Sub-Saharan Africa (SSA). The relationship between these two variables is complex and varies significantly depending on several factors, including institutional quality, sectoral dynamics, and technological advancements.

Financial development is crucial for economic growth and resilience, particularly in emerging and developing economies. By facilitating better information sharing, optimising resource allocation, and enhancing risk management, a robust financial sector can significantly contribute to economic stability and growth. For instance, research indicates that well-developed financial systems not only accelerate capital accumulation but also foster technological advancement by improving savings mobilization and investment efficiency[1]

Furthermore, financial development plays a crucial role in alleviating poverty and reducing inequality by expanding access to financial services for underrepresented groups. This access enables better risk management and enhances productivity, increasing income generation opportunities. The relationship between financial development and economic growth has been extensively studied, with findings suggesting that improvements in the financial sector often precede and stimulate economic expansion[2]

The relationship between financial development and the volatility of economic growth is intricate and has been explored in numerous studies. Some research indicates that a robust financial system can stabilize economic growth by alleviating financial constraints that amplify business cycles. Conversely, other studies suggest that the impact of financial development on growth is contingent upon various factors, including real and monetary shocks, credit supply dynamics, and the current stage of economic development[3]

In Sub-Saharan Africa, financial sectors are still in the nascent stages of development but are experiencing rapid growth. This swift expansion, coupled with existing vulnerabilities such as limited regulatory frameworks, presents risks to the stability of financial systems. While systemic banking crises are relatively rare on the continent, the accelerated growth of credit in many economies necessitates caution and the implementation of robust countercyclical regulations to safeguard African financial systems. Recent studies highlight that despite improvements in economic performance and financial inclusion driven by innovations like mobile money, challenges remain, including inadequate access to credit for households and businesses, which can hinder overall economic resilience and growth potential[4]

Research on the impact of financial development on economic growth has produced varied and sometimes contradictory findings. Some studies suggest that financial intermediaries can impede economic growth, while others indicate that financial development may contribute to macroeconomic instability. Recent investigations have highlighted a nonlinear relationship between key economic indicators—such as the monetary reserve ratio, openness to trade, bank reserve ratio, and money supply—and economic growth, often revealing a positive correlation.

Financial development is generally understood as the process through which financial institutions, markets, and instruments evolve to facilitate capital accumulation and efficient resource allocation. A well-functioning financial system is essential for promoting economic growth by enhancing savings mobilisation, improving investment efficiency, and fostering innovation. For instance, the World Bank emphasises that financial sector development plays a critical role in economic advancement by enabling better allocation of resources and supporting technological progress [5]

The study utilized a comprehensive methodology by integrating various variables to analyse the effect of financial development on economic growth, as indicated by real gross domestic product (RGDP). The explanatory variables comprised the ratio of bank liquid reserves to bank assets, the ratio of bank liquid reserves to total assets (R/A), and the growth of broad money, all of which act as indicators of financial development[6]. The primary variable of interest, which captures the influence of financial development on economic growth, includes domestic credit to the private sector by banks (D_Bank), total domestic credit to the private sector (D_all), and the broad money-to-total reserves ratio (M/R) [7]. To ensure a thorough analysis, the study also controlled several factors that could affect the relationship between financial development and economic growth, such as the consumer price index (CPI) to account for inflationary pressures, openness to trade (OPP), and the GDP deflator. By incorporating these variables, the study aimed to offer a detailed understanding of the relationship between remittance inflows and economic growth while minimizing the effects of potential confounding factors.

Additionally, the research highlights that financial development encompasses various dimensions, including the expansion of bank liquidity, monetary growth, and domestic credit to the private. This multidimensional approach is crucial as it reflects the diverse financial landscape present in Sub-Saharan Africa. Recent evidence suggests that financial sector

reforms in this region have led to increased access to financial services, which is essential for fostering entrepreneurship and stimulating economic activity[1].

This study presents a novel methodology for examining the relationship between financial development and economic growth, specifically focusing on Sub-Saharan African countries. The study incorporates the Generalized Method of Moments (GMM) for model selection by utilising panel regression techniques, including pooled analysis and fixed effects models. This approach is complemented by sensitivity analysis and dynamic panel regression analysis to bolster the robustness and reliability of the findings..

The System Generalized Method of Moments (SGMM) comprehensively explores the intricate relationship between financial development and economic growth. Recent literature indicates that this methodology is particularly effective in addressing potential endogeneity issues that can arise in econometric analyses. For instance, studies have shown that employing SGMM can yield more accurate estimates of the effects of financial development on growth by accounting for unobserved heterogeneity and dynamic relationships among variables[8]

The study's innovative methodology aims to clarify the relationship between financial development and economic growth and seeks to provide policymakers with actionable insights. Utilizing sophisticated econometric methods like System GMM analysis and performing comprehensive sensitivity tests, this research aims to enhance our comprehension of how financial systems can be structured to foster sustainable economic growth in Sub-Saharan Africa. The findings are instrumental for policymakers aiming to design effective financial sector reforms that promote stability and resilience in their economies.

2. Literature review

2.1 Review of **Theoretical Literature**

The conceptual link between financial development and economic growth in Sub-Saharan Africa (SSA) is multifaceted and has garnered significant attention in recent literature. Financial development is broadly defined as the evolution of the conceptual link between financial development and economic growth capital accumulation and efficient resource

allocation. This development is crucial for economic growth, particularly in SSA, where financial systems are often underdeveloped and face unique challenges [9]

A well-functioning financial sector plays a critical role in promoting economic growth by enhancing savings mobilisation, improving investment efficiency, and fostering technological innovation. According to the World Bank, financial development contributes to economic growth through several mechanisms: it increases the savings rate, mobilizes capital, provides information about investment opportunities, attracts foreign capital inflows, and optimizes capital allocation [5]**.** Countries with more developed financial systems tend to experience faster economic growth over the long term, suggesting a causal relationship where financial development drives growth rather than merely a consequence.

Despite the potential benefits of financial development, SSA faces significant obstacles. Many countries in the region have historically prioritized the real sector over the financial sector, leading to underdeveloped financial institutions that struggle to meet the needs of businesses and consumers. The legacy of government intervention in the financial sector has often resulted in inefficiencies and a lack of competition, which can stifle innovation and growth [10]

Financial depth, measured by indicators like broad money (M2/GDP) and financial system deposits (Deposits/GDP), reflects the capacity of the financial system to support economic activities. On the other hand, financial efficiency assesses how effectively resources are allocated within the financial system to enhance economic growth.

The theoretical framework surrounding the relationship between financial development and economic growth posits that a well-developed financial sector can significantly stimulate economic growth by facilitating investment, mobilizing savings, and optimizing resource allocation. Scholars such as King and Levine (1993) have provided substantial evidence supporting a positive correlation between financial development and economic growth across various countries. Their findings indicate that improvements in financial systems—such as banking and capital markets—are associated with higher economic growth rates, particularly in developing economies[1].

Moreover, Endogenous growth theory posits that investments in human capital, innovation, and knowledge are significant contributors to sustained economic growth. This perspective challenges traditional growth models that view technological progress as an exogenous factor. Instead, it highlights how financial development can enhance productivity and long-

term economic performance by facilitating better resource allocation and encouraging investment in technology and human capital[11].

[2]reinforced the relevance of these models in understanding the dynamics of financial development in various contexts. For instance, they demonstrate how improvements in financial systems can lead to increased savings and investment, which are crucial for fostering innovation and economic expansion. Additionally, the models underscore the importance of government policies promoting research and development, creating an environment conducive to growth.

2.2 **Empirical Literature Review**

Research focusing on emerging economies like the BRICS nations has shown a generally positive association between financial development and economic growth. A study utilizing the Generalized Method of Moments (GMM) found that indicators of banking sector development, such as the size of financial intermediaries and domestic credit to the private sector, significantly contribute to economic growth in these countries[1]

while market-based financial systems can promote growth, they may also induce volatility in less developed financial environments[12]. This suggests that the benefits of financial development are unique and can vary based on the stage of economic development and the balance between banking and market-based systems. On the other hand, [13]examined China using a generalized method of moment system estimation and found that financial sector development positively affected productivity growth. [14] focused on emerging European economies and discovered unidirectional causality between economic growth and financial sector development.

In the context of Cameroon, [14]) utilized the Johansen method of co-integration analysis and reported a positive effect of financial development on economic growth. [15] Studied 21 Sub-Saharan African countries using the dynamic panel GMM technique and established a positive link between financial development and economic growth. [16]They investigated SSA's financial development and economic growth, finding a positive impact in both countries when different estimation methods were used.

The research [17]in Cameroon and South Africa using VECM revealed a long-run relationship between bank deposits and economic growth in Cameroon, while South Africa

showed an independent relationship with different estimation methods. These studies collectively highlight the complex relationship between financial sector development and economic growth, showcasing varying impacts based on methodologies, countries, and specific characteristics.

A study by Zou et al. (2020) investigated the effects of financial development across different income groups within SSA. The findings indicated that while financial depth and intermediation negatively impacted per capita income growth in low- and middle-income countries, they had a positive effect in upper-income countries. This suggests that the benefits of financial development are not uniformly distributed and are contingent upon the economic context of each country[12].

System GMM analysis has provided valuable insights into the complex relationship between financial development and economic growth in Sub-Saharan Africa. The findings highlight the importance of considering income levels, institutional quality, and the balance between market-based and bank-based financial systems when designing policies to foster economic growth through financial development.

This literature review underscores the importance of considering diverse perspectives to understand the nuanced effects of financial development on economic growth across different regions globally.

3. METHODOLOGY AND DATA

This section outlines the theoretical framework underpinning the study and the estimation techniques employed in the analysis. Additionally, it details the definitions of key variables and the sources of data utilized for the empirical investigation

3.1 Theoretical framework

The theoretical framework for this study is grounded in the relationship between financial development and economic growth, drawing from several critical economic theories. The Schumpeterian theory posits that financial systems play a crucial role in fostering innovation and entrepreneurship, which are essential drivers of economic growth. According to this perspective, a well-developed financial sector enhances resource allocation, facilitates investment, and promotes technological advancement.

Recent research highlights the importance of financial markets in facilitating capital accumulation and enhancing productivity through improved resource allocation. For instance, Levine (1997) argues that financial systems serve as crucial intermediaries that channel savings into productive investments, thereby fostering economic dynamism.

3.3 Data and Measurement

Table 1 outlines the variables we examined, their anticipated signs, and the rationale for their inclusion in our study. Our investigation spans 42 countries in Sub-Saharan Africa from 1998 to 2022, selected for their availability of Financial Development data during this period. We collected data on a range of indicators, including OPP, BRR, R/A, and M/R, as well as GDPD, D_all, D_bank, M_G, and CPI, which serves as a proxy for inflation, from the World Development Indicators (WDI) database (World Bank, 2021). For data analysis, we employed Stata 15.0 statistical software. By leveraging the robust command in Stata and the System GMM methodology, we effectively tackled heterogeneity and endogeneity challenges in our analysis. Additionally, we performed multiple diagnostic tests to verify the accuracy of our variables and the dependability of our findings**.**

Authors	Type of Study	Econometric Model Used	Number of countries	The measure of financial development	Summary of finding
Demetriades and James (2011)	Panel(1975–2006)	Westerlund cointegration	18	Bank deposit, liquid liability, and private credit.	Evidence of demand-led hypothesis.
Walle (2014)	Panel (1975–2005)	Westerlundcointegration and DOLS	17	Liquid liability and private credit,	A long-run relationship exists, and Causality runs from finance to growth.
Acaravci, Ozturk and Acaravci (2009)	Panel(1975–2005)	GMM and Padroni co-integration	24	Domestic credit by the banking sector, private credit, and liquid liability.	The direction of Causality depends on the measure of financial development
Aluko et al. (2020)	Panel (1990–2015)	Dumitrescu and Hurlin (2012)panel causality model	33	Financial Development Index	Bidirectional relationship between finance and growth.
An et al. (2020)	Panel (1985–2015)	FE and RE models. Granger causality test	30	Liquid liability, broad money supply, domestic credit by banks to the private sector, and interest	The difference depends on the income; negative impact in countries with low income while it is positive in the case of higher-income countries
Taiwo (2020)	anel (1986–2015)	Hansen threshold mod	38	Domestic credit	Finance has a positive impact on growth
Fowowe (2011)	Panel (1975–2005)	Panel Granger Casuality	17	Bank credit and bank deposit liabilities.	Bi-directional Causality between finance and growth.
Asaleye et al. (2018)	Time series (1981–2016)	ECM and Causality test	Nigeria	private credit, market capitalization	Uni-directional Causality from finance to growth.

table 1 Summary of recent studies on the relationship between Financial Development and Economic growth in SSA

4. Results and Discussions

4.1 descriptive analysis

The summary statistics from Table 2 provide valuable insights for the countries under consid eration:

Real Gross Domestic Product(**RGDP**). It has 1,152 observations with a mean value of 22.92435, a standard deviation of 1.480331, a minimum value of 18.77475, and a maximum value of 27.00616. This suggests that the average real GDP is approximately 22.92, with a relatively low standard deviation indicating that the values are relatively close to the mean. The Bank liquid reserves to bank assets ratio (**R/A**) has 920 observations with a mean of 2.878732, a standard deviation of 0.8249815, a minimum of 0.4937103, and a maximum of 5.966429. This indicates that the average value of this variable is around 2.88, with a relatively high standard deviation suggesting a wide spread of values.

Openness to Trade (OPP) is characterized by 899 observations, with a mean of 0.6994543, a standard deviation of 0.4374776, a minimum of 0.0631788, and a maximum of 3.650533. Gross Domestic Product per Capita (GDPD) comprises 1,152 observations, with a mean of 11.56909, a standard deviation of 2.397545, a minimum of 4.526336, and a maximum of 16.58105. Broad Money Growth (M_g) is represented by 1,089 observations, with a mean of 3.232526, a standard deviation of 0.6595083, a minimum of 3.344119, and a maximum of 5.174956. A negative minimum value for M_g indicates that this variable can assume negative values, suggesting the possibility of a deficit or negative outcomes in certain instances.

Inflation(**INF**), with 1,018 observations. The mean is 1.820943, the standard deviation is 1.2 23747, the minimum is 4.696737, and the maximum is 7.874786. Gross Domestic Product deflator with 1,152 observations. The mean is 4.472884; the standard deviation is 1.002485; domestic credit to the private sector by banks (**D_Bank**) has 1,105 observations. The mean is 2.385485; the standard deviation is 1.391494. Domestic credit to the private sector (**D_alll**) has 1,035 observations. The mean is 2.407192; the standard deviation is 1.438639, whereas the Broad money-to-total reserves ratio(**M/R**) is with 876 observations.

These statistics provide a comprehensive overview of the economic health and performance of the countries under consideration, offering insights into various economic indicators and their implications.

Table 2 Summary of Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
RGDP	1,152	22.92435	1.480331	18.77475	27.00616
R/A	920	2.878732	.8249815	.4937103	5.966429
OPP	899	.6994543	.4374776	.0631788	3.650533
GDPC	1,152	11.56909	2.397545	4.526336	16.58105
M_g	1,089	3.232526	.6595083	-3.344119	5.174956
INF	1,018	1.820943	1.223747	-4.696737	7.874786
GDPD	1,152	4.472884	1.002485	-1.664606	11.90103
D_Bank	1,105	2.385485	1.391494	-6.473036	4.652518
D_All	1,035	2.407192	1.438639	-6.429156	4.958795
M/R	876	1.061829	1.129862	-6.06905	7.132923

4.2 Financial development (R/A, M_G, M/R) and Economic growth

As depicted in **Table 3**, South Sudan, Eritrea, Comoros, and Angola are the first four countries with a greater mean value of **Bank liquid reserves to bank assets ratio(R/A)** values of 5.14, 4.31, 4.031, and 3.57 respectively. This may be due to banks perceiving limited lending opportunities, and they may allocate more assets to liquid reserves. This decision arises from cautious lending practices or a lack of creditworthy borrowers. The consequence is that they may extend fewer loans to businesses and individuals. This can dampen economic growth and investment. On the other hand, South Africa, Namibia, Mauritius, and Lesotho are found to have the lowest mean value of R/A with 1.29,1.46,1.68 and 1.96, respectively. **Bank liquid reserves to bank assets ratio(R/A)** values of Ethiopia and Somalia are not recorded.

The broad money growth (**M_G**) of Zambia, Sao Tome, Principe, and Seychelles has the highest mean values of 2.977, 2.95, and 2.92, respectively. On the other hand, Mauritania, Eritrea, and Equatorial Guinee are the three countries that get the lowest mean values of D_all in sub-Saharan countries; their mean values are 0.256, 1.03, and 1.8, respectively.

In the case of the Broad money-to-total reserves ratio(**M/R**), Benin, Angola, and Senegal have the highest mean values of M/R, which are 1.7, 1.66, and 1.57, respectively. On the other hand, Sub-Saharan African countries with the lowest mean values of M/R are Zimbabwe, Guinea-Bissau, and Lesotho, which have mean values of 0.42, 0.507, and .6105, respectively.

Table 3 The mean and standard deviation of financial development across Sub-Saharan Africa

Country	Variable R/A Mean	St.Dev	M-G Mean	St.Dev	M/R Mean	St.Dev	Country	Variable R/A Mean	St.Dev	D-All Mean	St.Dev	M/R Mean	St.Dev
Angola	3.557784	0.289	2.302048	0.672	1.66	1.88	Liberia	3.29	0.033	2.495	1.91	0.912	0.67
Benin	2.22	0.5368	2.255	1.058	1.7	1.63	Madagascar	3.2	0.25	2.53	0.6	0.65	0.799
Botswana	3.36	0.734	2.3	0.68	1.44	1.66	Malawi	3.5	0.23	2.4	1.9	1.09	1.01
Burkina Faso	2.05	0.297	2.3	1.07	1.41	1.85	Mali	2.47	0.242	2.52	0.569	0.702	0.81
Burundi	2.4	0.543	2.024	0.89	1.28	1.3	Mauritania	2.99	0.154	**0.256**	1.94	0.986	0.98
Cabo Verde	3.4	0.24	2.42	1.05	1.48	1.69	Mauritius	1.68	0.68	2.7	0.69	0.75	0.077
Cameroon	3.34	0.28	1.905	1.11	1.18	1.35	Mozambique	3.2	0.51	2.53	1.95	1.0441	0.937
CAR	2.37	0.82	1.91	2.231	1.22	1.21	Namibia	1.46	0.44	2.75	0.657	0.86	0.761
Chad	3.06	0.49	1.92	1.08	1.22	1.02	Niger	2.52	0.34	2.54	1.84	1.167	0.983
Comoros	4.031	0.32	1.97	1.076	1.11	0.95	Nigeria	3.23	0.66	2.87	0.64	0.82	0.467
Congo DR	2.4	0.33	1.97	1.076	1.11	0.953	Rwanda	2.74	0.258	2.59	1.82	1.42	1.42
Cong R	3.59	0.6	1.94	2.211	1.07	0.97	Sao Tome and Principe	3.56	0.44	2.95	0.618	0.99	0.735
Cote d'Ivoire	2.38	0.486	2.15	0.91	0.89	1.01	Senegal	2.51	0.26	2.54	1.78	1.57	1.51
EGG	3.8	0.81	1.8	2.05	0.81	1.03	Seychelles	2.54	0.364	2.92	0.65	0.94	0.69
Eritrea	4.31	0.28	1.03	1.8	1.11	1.06	Sierra Leone	2.69	0.328	2.42	1.85	1.67	1.35
Eswatini	2.3	0.41	2.3	1.04	0.8	1.33	Somalia	.	.	2.54	1.82	0.9	0.296
Ethiopia	.	.	2.1	1.9	1.04	0.91	South Africa	1.29	0.22	2.74	0.84	1.5	1.16
Gabon	3.18	0.59	2.26	0.82	0.644	1.16	South Sudan	5.14	0.449	2.55	1.876	0.88	0.33
Gambia, The	3.3	0.27	2.18	0.829	0.64	1.16	Sudan	3.54	0.57	2.75	0.58	1.35	1.017
Ghana	3.19	0.36	2.37	0.6	0.72	1.19	Tanzania	2.96	1.6	2.55	1.92	1.006	0.41
Guinea	3.5	0.209	2.31	1.86	1.1	0.87	Togo	2.16	0.32	2.75	0.6008	1.467	1.264
Guinea-Bissau	2.88	0.67	2.32	0.73	0.507	0.85	Uganda	2.98	0.218	2.62	1.87	0.95	0.423
Kenya	2.22	0.17	2.4	1.85	0.75	0.83	Zambia	3.32	0.266	2.977	0.605	1.09	0.64
Lesotho	1.96	0.301	2.42	0.67	0.6105	0.8227	Zimbabwe	3.17	7.8	2.52	1.97	0.402	2.46

Apendex1 showcases the correlation matrix derived from the study. The analysis reveals that the ratio of Bank liquid reserves to bank assets ratio to GDP (R/A) exhibits a weak negative correlation of -0.0893 with the real GDP of SSA Africa. Additionally, the correlation matrix indicates that the ratio of outflows to GDP (OPP) and monetary growth to GDP (M/R) are positively and weakly correlated with real GDP. Furthermore, it is noted that monetary growth (M-g), inflation (CPI), and the ratio of deposits to bank assets (D-bank) display positive, albeit weak, correlations with real GDP (RDGP).

The positive correlation between R/A and M/R suggests that the monetary reserve ratio to the bank and liquid assets may adversely affect economic growth in SSA countries. The existence of positive and negative correlations between remittances and economic growth provides a basis for examining the extent to which remittances influence economic growth in SSA during the specified periods.

5. Conclusions and policy implications

The study on financial development and economic growth in Sub-Saharan Africa using System GMM analysis has provided valuable insights into the complex relationship between financial development indicators and economic performance in the region. Based on the empirical findings and discussions presented in the research, the following conclusions and policy implications are forwarded.

The study reveals a positive and significant impact of financial development indicators like bank liquid reserves to bank assets ratio (R/A), trade openness, and the broad money to total reserves ratio (M/R) on economic growth in Sub-Saharan Africa. This underscores the importance of a well-developed financial sector in fostering economic growth and stability. On the other hand, domestic credit provided to the private sector by banks (D_bank) has a negative and significant impact on the economic growth of Sub-Saharan Africa (SSA).

Policymakers in Sub-Saharan Africa should focus on enhancing financial sector development to promote economic growth. This includes improving liquidity, increasing trade openness, and ensuring efficient resource allocation through sound financial intermediation.

Given the rapid growth of financial sectors in the region and existing vulnerabilities, strong regulatory frameworks are needed to maintain financial stability. Countercyclical regulations should be implemented to mitigate risks associated with fast credit growth.

Further Research: Future studies should delve deeper into the specific mechanisms through which financial development influences economic growth in Sub-Saharan Africa. Exploring the impact of different financial instruments, regulatory policies, and institutional factors can provide more nuanced insights into this relationship.

Appendix 1

CORROLATION

	lnRGDP	lnbR/A	opp	GDPC	lnM-G	lnINF	lnM	GDPD	lnD_bank	lnD_All	lnM/R
lnRGDP	1.0000										
lnR/A	-0.0893	1.0000									
OPP	-0.0564	-0.0137	1.0000								
GDPC	-0.0137	-0.0408	0.0705	1.0000							
lnM_g	0.0158	0.0589	0.0592	-0.1328	1.0000						
lnINF	0.0014	-0.0071	-0.0088	-0.1432	-0.2023	1.0000					
lnM	0.0079	-0.0066	0.0751	0.1120	0.6167	-0.2003	1.0000				
GDPD	0.0037	-0.0901	0.0973	0.3887	-0.0732	0.0615	-0.1044	1.0000			
lnD_Bank	0.0083	-0.0068	0.0751	0.1140	0.6151	-0.2012	0.9999	-0.1022	1.0		
lnD-All	0.0067	-0.0021	0.0689	0.1064	0.6210	-0.1944	0.9969	-0.0998	0.9969	1.0	
lnM/R	-0.0154	0.0616	-0.0090	-0.1793	0.2943	0.0950	0.1995	0.0024	0.1984	0.2053	1

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