Impact of Primary Market on Economic Growth: A Cross Country Analysis

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Impact of Primary equity market on Total Factor Productivity: A Cross-Country Analysis

Abstract:

Schumpeter (1911) argued that entrepreneurial finance causes absorption of innovation in economy and productivity growth. Andriansyah and Messinis (2014), however, reported an insignificant relationship between the primary equity market and economic growth, and suggested exploration of the routes through which the primary equity market may affect economic growth. In the present study we examined the impact of the primary equity market on total factor productivity (TFP) and non-TFP growth in a cross-country setting using panel data analysis and the GMM approach. We employed published data relating to 87 countries for the period 1990-2014. We found a positive impact of the primary equity market on TFP in both developed and developing economies, without a significant difference. The impact of the primary equity market on non-TFP growth was found to be significant in developing economies only. The findings suggest that the primary equity market boosts growth in all economies, but the impact is higher in developing economies. Findings of the study suggest that policy makers should focus on developing primary equity market to foster economic growth.

Key words: Primary equity market, Total factor productivity, Schumpeter model, Mckinnon model, Economic growth

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1. Introduction

Total factor productivity (TFP) is residual growth in the Solow (1956) model after accounting for the contribution of capital and labor in total economic growth (Growth). The finance–growth literature argues that finance brings growth through two routes, a quantitative channel, and a qualitative channel (Ang, 2008). The quantitative channel of growth is the growth that an economy achieves through capital and labor accumulation. The qualitative channel (TFP growth) is the component of growth that is achieved through innovation absorption in the economy. Schumpeter (1911) described five categories of innovation: (1) introduction of a new commodity; (2) introduction of a new method of production; (3) discovery of a new market; (4) discovery of a new source of material; and (5) introduction of change in the organization of any industry, or in the form of business organization (Dholakia and Dholakia, 1998).

Schumpeter (1911) argued that entrepreneurs bring about a qualitative change in an economy and that entrepreneurship needs credit. Hence, according to Schumpeter (1911), factor productivity growth is not possible

without entrepreneurial finance. The Mckinnon (1973) model also maintains that entrepreneurial finance is the driver of entrepreneurship and economic growth in developing countries. Tobin and Brainard (1963) argue that financial development leads to a better ability to evaluate projects, thereby improving the quality of investment and the efficiency of resource allocation, which in turn leads to an expansionary effect on the economy.

Various empirical researchers have found that banking and stock market development increases factor productivity in the economy. King and Levine (1993a), Levine and Zervos (1998) and Benhabib and Spiegel (2000) studied the relationship between financial development and TFP growth and found it to be positive. Rioja and Valev (2004) reported that financial development affects growth in richer countries via productivity growth and in poorer countries mainly via capital accumulation. Tobin and Brainard (1963), Townsend (1979), Greenwood and Jovanovic (1990), King and Levine (1993b), Neusser and Kugler (1998), Beck et al. (2000) and Calderon and Liu (2003) argued that financial development affects growth via the TFP route. King and Levine (1993a) found that many indicators of financial development are positively and strongly related to real per capita gross domestic product (GDP) growth, rate of physical capital accumulation, and TFP growth.

The primary equity market facilitates firms raising new capital from the public for the growth of the firm. Venture capital/private equity (VC/PE) firms use the initial public offering (IPO) route to exit from their investments. Several researchers have argued that a vibrant primary equity market drives VC/PE investment (Kaplan and Schoar, 2005; Black and Gilson, 1998; Jeng and Wells, 2000). It is argued that the IPO market explains variations in investment across countries (Bonini and Alkan, 2012). The IPO market also acts as an exit channel for VC/PE firms (Groh et al. 2013). VC/PE firms are among the key determinants of growth in innovation and entrepreneurship (Faria and Barbosa, 2014; Popov and Roosenboom, 2013). Entrepreneurs investing in high-risk projects prefer VC over bank finance (Wintona and Yerramillib, 2008). The above arguments suggest that the primary equity market facilitates entrepreneurial finance at a mature stage and in addition, may foster financing at an early stage via VC/PE financing.

The literature suggests that the primary equity market contributes to capital accumulation and its efficient allocation, spurs entrepreneurial activities, and encourages investment in new technology. All these activities contribute to factor productivity growth as per economic growth theory. We, therefore, argue that primary equity market growth is likely to be positively associated with TFP growth in an economy. However, no research to our knowledge has examined the impact of primary equity market growth on TFP growth. The aim of this paper is to examine the role of the primary equity market in TFP growth. Going by Schumpeter's argument that entrepreneurial

finance brings about a qualitative change in an economy and thereby increases factor productivity, this paper studied the impact of the primary equity market on TFP using data from 87 countries covering 25 years (1990–2014).

The structure of the rest of the article is as follows. Section 2 deals with theoretical development on finance and factor productivity relationship. Section 3 discusses global trends in the primary equity market and TFP during the sample period, section 4 discusses the methodology, and section 5 presents description of data. Section 6 contains diagnostic tests of data and model, in section 7 results and analysis are discussed, section 8 explains the primary equity market–TFP–Growth puzzle. Summary and conclusion are given in Section 9, section 10 discusses policy implications, and section 11 outlines the limitations of the study and suggests future research directions.

2. Theoretical development on finance and factor productivity

TFP is defined as economic growth not explained by the accumulation of capital and labour alone. As per the neoclassical economic growth model, using Cobb Douglas form of production function the growth equation can be derived as follows.

$$Y = K^{\alpha}L^{(1-\alpha)}A^{(1-\alpha)} \quad \ldots.(1)$$

Where Y is the gross domestic product (GDP), K is gross capital invested in the economy, L is total labour input, A is technology, α is output elasticity of capital, and (1- α) is output elasticity of labour.

From (1) after taking log and differentiating, we have

$$dY/Y = \alpha.dK/K+(1-\alpha).dL/L+(1-\alpha).dA/A \quad \ldots.(2)$$

$$G = K_g+L_g+TFP \quad \ldots.(3)$$

Where G is economic growth, K_g (α.dK/K) is capital driven growth, L_g ((1- α).dL/L) is Labour input driven growth, and TFP is residual economic growth.

Theories from corporate finance also suggest that the asset pricing function of the financial market should play a role in productivity and economic development. The equity market is a significant part of the financial market in terms of providing new capital for investment, and investment leads to economic growth. Private investment depends on the availability of projects with a positive net present value (NPV).

$$\text{Net present value of a project} = \sum \frac{\text{operating cash flow from the project in year } t}{(1+\text{risk free rate}+\text{ risk premium})^t} - \text{Present value of total investment}$$

where *t* is the number of years and summation is taken over the life of the project. An entrepreneur invests in a project if the value is positive.

By improving asset pricing efficiency, investment in good projects is increased and investment in bad projects is reduced. Reducing the cost of capital via improved efficiency is a market-driven approach and should be preferred to a repressionist approach (Keynes, 1936). Regulations that keep interest rates low (financial repression), benefit all kinds of projects, good as well as bad. A market-driven approach reduces the cost of capital for good projects and increases the cost of capital for bad projects, leading to a better quality of investment, productivity, and economic growth. Thus, we should expect a positive impact of equity market development on productivity and growth. Tobin and Brainard (1963) argued that more financial development leads to better ability to evaluate a project that improves the quality of investment and hence more efficient allocation of resources which leads to improved quality of investments that can have an expansionary effect on the economy.

3. Primary equity market and TFP data: Sources and trend

The data and their sources are presented in Table 1. Primary equity market data for 134 countries were found in Thomson database for the sample period. Instead of estimating TFP data, we have used the published database of total factor productivity by Conference Board. This database is used in various published literature. Due to the limited data available for the other key variables in other sources, we had to finally restrict our study to 87 countries.

Table 1: Sources of data used in the study

Data	Source
Data on primary capital raised	Thomson Reuters Eikon
Data on macroeconomic variables	World Bank database[1]
Data on financial market variables	World Bank database
Total factor productivity	Conference Board[2]

*Data period from 1990–2014.

A graphical view of the primary equity market–TFP relationship is presented in Figures 1 and 2. From Figure 1, it appears that economic growth and TFP are in a close relationship. Figure 2 shows that most of the time (except for the dot-com bubble period, 1995–2001), the primary equity market/GDP ratio precedes the trend in TFP. This suggests that the primary equity market is leading changes in TFP.

[1] http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators
[2] https://www.conference-board.org/data/economydatabase/index.cfm?id=27762

Figure 1: TFP vs. GDP growth (based on annual summary of data of sample countries)

(GDP/capita data are scaled by a factor of 2 for a closer view of the pattern)

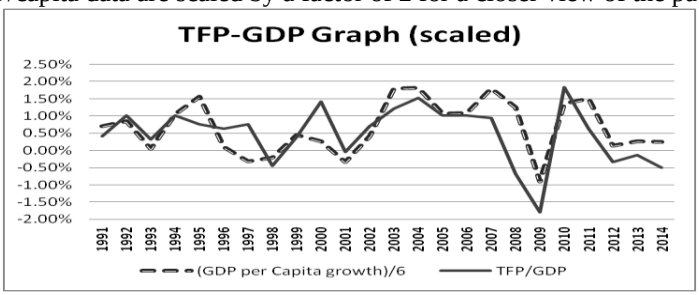
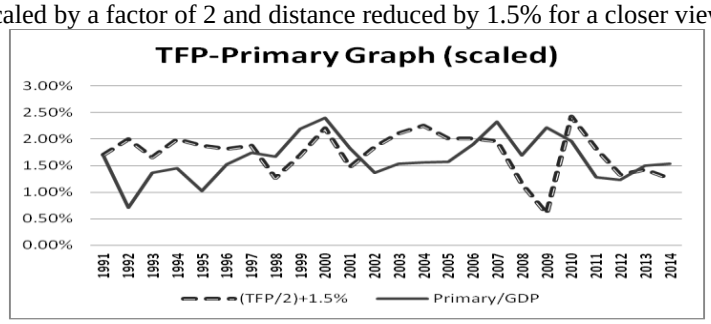


Figure 2: Primary equity market–TFP graph (based on annual summary of data from sample countries)

(TFP data are scaled by a factor of 2 and distance reduced by 1.5% for a closer view of the pattern)



4. Hypothesis and Methodology

Based on the discussion in the previous section about the role of the primary equity market in economic growth and development, we argue that the primary equity market should positively affect TFP growth and economic growth. This section discusses the hypotheses and mathematical models that are used to test the hypotheses. Following hypotheses were tested:

Hypothesis 1: Primary equity market increases TFP growth

Hypothesis 2: Primary equity market-TFP relationship is not affected by the 2008 financial crisis

Hypothesis 3: Primary equity market-TFP relationship is not affected by the income level of the country

Hypothesis 4: Primary equity market growth leads to TFP growth

Hypothesis 5: Primary equity market granger causes TFP growth

Hypothesis 6: Primary market has a long term relationship with TFP growth

Hypothesis 7: Primary market growth – "non-TFP" growth relationship is affected by income level of the country

To examine above hypotheses, except the causality and cointegration test, we followed the model used by Andriansyah and Messinis (2014). We estimated Equation 4 to study the primary equity market–TFP relationship:

$$TFP_{i,t} = \beta_0 + \beta_1 Primary_{i,t} + \beta_2 STOCK_{i,t} + \beta_3 BANK_{i,t} + \beta_4 TFP_{i,t-1} + \beta_5 X_{i,t} + \eta_i + \epsilon_{i,t} \quad \ldots\ldots (4)$$

Further, we estimated Equation 5 to study the impact of primary equity market on non-TFP growth using following equation:

$$PGDP_{i,t} = \beta_6 + \beta_7 * Primary_{i,t} + \beta_8 * STOCK_{i,t} + \beta_8 * BANK_{i,t} + \beta_{10} * PGDP_{i,t-1} + \beta_{11} * TFP_{i,t} + \eta_i + \epsilon_{i,t} \quad \ldots\ldots..(5)$$

In above equations, β_i are the parameters to be estimated, *TFP* is total factor productivity, *Primary* is the primary equity market, *STOCK* is the secondary market for equity, *BANK* is banking development, *X* is a set of control variables, η_i is an unobserved fixed effect and $\epsilon_{i,t}$ is the error term for i^{th} country and t^{th} year. All the data are in current US dollars. The proxy for Primary is the total primary equity issue/lagged GDP (Doidge, 2013). The proxy for *STOCK* (secondary stock market) is the stock traded turnover/GDP (Andriansyah and Messinis, 2014). The proxy for *Bank* (banking development) is total private credit (King and Levine, 1993a). Because countries differ in size, to benchmark financial market activity the stock market is scaled by GDP (Andriansyah and Messinis, 2014), and private credit is also scaled by GDP (King and Levine, 1993a). Primary equity market issuance is scaled by the lagged value of GDP, as suggested in Doidge (2013). Independent variables that are in percentage form are not modified further.

The lag of *TFP* is considered as the control variable (Andriansyah and Messinis, 2014). Following Barro and Sala-i-Martin (2009), Barro (1991), Beck et al. (2000), Jeanneney et al. (2006) and Arizala et al. (2013), we have used five other variables, schooling, inflation, government expenditure, foreign direct investment and external trade, as control variables in our initial estimates. These are also used as exogenous instruments following Andriansyah and Messinis (2014).

Breitenlechner et al. (2015) report that the association of Banking development and Stock market with economic growth has reduced due to economic shock of 2008. We examined the impact of the 2008 financial crisis on the *Primary–TFP* relationship by adding an interaction term of primary equity markets with a dummy variable "*D2008*" for the period post 2008.

$$TFP_{i,t} = \beta_0 + \beta_1 Primary_{i,t} + \beta_{12} * Primary_{i,t} \text{ x } D2008 + \beta_2 STOCK_{i,t} + \beta_3 BANK_{i,t} + \beta_4 TFP_{i,t-1} + \beta_5 X_{i,t} + \eta_i + \epsilon_{i,t}$$

…… …… (6)

Economic theories argue that TFP growth is a function of technological absorption only. The literature suggests that the primary equity market relationship with economic growth varies with the income level of economies, therefore we estimated impact of income level on *Primary–TFP* relationship (difference GMM) by adding interaction

terms for dummy variables for various income categories (L, LM, UM, H)[3] as defined in world bank classification with the primary equity market.

$$\boldsymbol{TFP}_{i,t} = \beta_0 + \beta_1\, \boldsymbol{Primary}_{i,t} + \beta_{12} * \boldsymbol{Primary}_{i,t} \times \boldsymbol{Income\ level} + \beta_2\, \boldsymbol{STOCK}_{i,t} + \beta_3\, \boldsymbol{BANK}_{i,t} + \beta_4\, \boldsymbol{TFP}_{i,t-1} + \beta_5\, \boldsymbol{X}_{i,t} + \eta_i + \epsilon_{i,t} \quad \ldots\ldots\ldots\ldots (7)$$

For examining structural relationship between *Primary* and TFP, we performed some more tests. We used a Panel VAR test on TFP–Primary relationship to examine whether primary equity market granger causes TFP growth or TFP growth causes primary equity market growth. We performed the Pedroni cointegration test to examine whether the primary equity market has a long term relationship with TFP growth.

To examine supply leading or demand following argument (Patrick 1966) empirically, we estimated following equation 8 along with the equation 4, following Andriansyah and Messinis (2014)

$$\boldsymbol{Primary}_{i,t} = \beta_0 + \beta_1\, \boldsymbol{Primary}_{i,t-1} + \beta_2\, \boldsymbol{STOCK}_{i,t} + \beta_3\, \boldsymbol{BANK}_{i,t} + \beta_4\, \boldsymbol{TFP}_{i,t} + \beta_5\, \boldsymbol{X}_{i,t} + \eta_i + \epsilon_{i,t} \quad \ldots\ldots (8)$$

Finally, we examined the structural relationship between the TFP growth and explanatory variables (*Primary, STOCK, BANK*) using differenced variables (difference of the variable from its lagged value) and lag of differenced variables in the equation (9) instead of using level variables. Subrahmanyam and Titman (1999) describe the relationship between the primary equity market and the stock market as a snowball effect. More share listings increase stock market size and liquidity, and a growing stock market encourages more IPOs and listings. Following Andriansyah and Messinis (2014), we examined the *Primary–TFP* relationship as part of the system in Equation 9. The argument is that the primary equity market, along with banks, the stock market, and TFP, may be simultaneously determined. We modeled simultaneous equations using the auto regressive distributed lag, ARDL (1), approach (Andriansyah and Messinis, 2014) as:

$$\boldsymbol{Y}_{i,t} = \beta_0 + \beta_j * \boldsymbol{y}_{i,t-1} + \eta_i + \epsilon_{i,t} \quad \ldots\ldots\ldots\ldots (9)$$

where β_s are the parameters to be estimated, η is the fixed effect, ϵ is the error term for Y_i for i=1 to 4, Y=[*TFP, Primary, STOCK, BANK*] and **y** excludes the contemporary dependent variable.

We estimated equations in the system of Equation 9 separately following Andriansyah and Messinis (2014). These authors claim that there are cross-error correlations in the different equations and that estimating separately avoids the sensitivity of misspecification in any individual equation that can occur in joint estimation. Other reasons

[3] L, LM ,UM, H represent lower income, lower middle income, upper middle income, and high income level for an economy. The income level is defined by the World Bank every year based on the per capita income of the country.

are that GMM does not handle simultaneous equations in the panel. Addressing the fixed effect and the need for valid and strong instruments may affect joint estimation. Estimating all equations individually reduces this problem.

A dynamic panel is considered for analysis which is also the default model in the generalized method of moments [GMM]) and, accordingly, the lag of the dependent variable is included as the only control variable. Several researchers have used a 5–10-year average to study the finance–growth relationship. However, Aretis and Demetriades (1997) argue that averaging annual data series creates an average effect limitation and reduces the scope for capturing individual idiosyncrasies. Therefore, we used annual series for analysis.

Considering endogeneity in variables in the model, we have used the GMM technique (both difference and system) for estimating the parameters. We included both forms of GMM because our sample is not small, and it provides an additional robustness check of the relationship. The moment conditions for difference and system GMM estimates are, respectively:

$$E[Y_{i,t} * \Delta\epsilon_{i,t}] = 0 \quad \text{for i = 1…4; and t = n+2……T} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

$$E[\Delta Y_{i,t} * \epsilon_{i,t}] = 0 \quad \text{for i = 1…4; and t = n+2……T} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (10)$$

where Y_i is the dependent variable, ϵ is the composite error, and n depends on the lag structure of ϵ. For no autocorrelation in the composite error, n=0.

5. Description of data

Table 2 presents descriptive statistics. Three components of the financial market data represent separate aspects and hence are not comparable in the summary. Private credit data is a stock variable, and primary equity market and stock market data are flow variables. Over the sample period of 25 years, the average new capital raised per year through the primary equity market is 1.75% of GDP. The average value of the primary equity market seems to be much lower than the other two components of financial markets (27.43% for stock market and 63.51% for bank credit). Though as a source of finance, Bank looks very high, it is a stock variable with 44.36% mean value in 1990 and 76.45% mean value in 2014. This means approximately 1.34% (of GDP) increase per year. Hence in terms of new capital, funds raised through the primary equity market are higher than those raised in the form of private credit.

The correlation matrix (Table 3a) shows that the correlation of bank credit and stock market with TFP is higher than that of the primary equity market. Partial correlations suggest that the primary equity market has a larger positive correlation with TFP (Table 3b). The partial correlation of GDP and Bank is negative.

Table 2: Summary statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
TFP	2,136	0.52289	3.870096	-54.3287	59.37093
Log GDP/Capita	2,136	8.74421	1.569336	4.800033	11.66662
Primary	2,136	1.239007	2.204517	0	26.44221
Stock	2,136	27.43452	56.46075	0	952.6673
Bank	2,114	63.51344	49.30415	1.125519	312.1536

Table 3a: Correlation and partial correlation matrix

	TFP	LogGDP/Capita	Primary	Stock
Log GDP/Capita	-0.0575			
Primary	0.0025	0.3119		
Stock	0.0275	0.3257	0.5387	
Bank	-0.0735	0.5953	0.4025	0.4678

Table 3b: Partial correlation matrix (with L.TFP)

Variable	Partial Corr.	Semi-partial Corr.	Partial Corr.^{2}	Semi-partial Corr.^{2}	Significance Value
L.TFP	0.2105	0.2088	0.0443	0.0436	0
Log GDP/Capita	-0.0108	-0.0105	0.0001	0.0001	0.0001
Primary	0.0124	0.012	0.0002	0.0001	0
Stock	0.0539	0.0524	0.0029	0.0027	0
Bank	-0.089	-0.0866	0.0079	0.0075	0

6. Diagnostic tests of data and model

Following choi(2001) we conducted Fisher-type unit-root test on our unbalanced panel and found no unit roots in the data after controlling for trend/mean/drift. Other stationarity tests[4] also confirmed this. The Fisher test is argued to be more powerful than the IPS (Im–Pesaran–Shin) and LLC (Levin–Lin–Chu) tests (Baltagi, 2008). The Fisher-type unit-root test reports four statistics; however, Choi (2001) argues that for a long panel the modified inverse chi-square Pm test statistic is better. Endogeneity test[5] suggested that all the explanatory variables in the modeled equation (4) and (5) were endogenous.

The Hausman test suggested fixed effect at 1% significance level. Considering endogeneity and fixed effects, we chose the GMM estimation technique. We report results for both system GMM and difference GMM.

The lag length for the instrument is determined as per Roodman (2009). The maximum lag is chosen to avoid the problem of too many instruments and to see that the instruments are valid as per the Hansen-J and AR tests. The

4 For a robustness check, we also conducted IPS and LLC tests on the balanced data part by removing a few countries that have fewer data.
5 xtivreg2 command in Stata provides endogeneity test for a variable using Durbin-WU-Hausman test. The null hypothesis is that regressor is exogenous.

Hansen-J test is preferred over the Sargan test due to the robustness of the Hansen-J test for non-normal errors. We applied principal component analysis (PCA) and the collapsing technique wherever required. We tested our model for year fixed effects. The test suggests that a year fixed effect exists. Roodman (2009) also suggests adding 'Year' as a variable in GMM models to satisfy the assumption of GMM. Therefore, we added 'Year' in our models.

We applied a modified Wald statistic to test for group-wise heteroscedasticity. The null hypothesis that groups have equal variance was rejected at 1% significance. We applied the Pesaran CD test for checking cross-sectional independence. The null hypothesis that residuals are uncorrelated was not rejected. We applied the LM test for serial correlation in group errors. The null hypothesis of no first-order autocorrelation was rejected at 1% significance level. Thus, the results suggest group-wise heteroscedasticity and group-wise serial correlation in the panel. Therefore, error robustness for cluster around groups (i.e., country) is preferred, which is robust for serial correlation as well as for heteroscedasticity.

7. Results and analysis

We used the GMM technique to estimate the parameters. To obtain a valid estimate we used collapsing/ PCA[6], which reduces the instruments and singularity of the covariance matrix used in the second stage. With the collapsing/ PCA technique, now the number of instruments, AR test, and Hansen-J test satisfy the requirement. We first estimated our models by including five variables, inflation, schooling, foreign direct investment (FDI), government expenditure, and external trade, as control variables (Barro, 1991), along with lag-TFP also as control. We estimated the parameters with/without these five variables as exogenous instruments.

Hypothesis 1 was tested by estimating coefficients of the equation 4. The results are presented in Table 4. Initial estimates suggest that the primary equity market is significant and positive: 1% increase in the primary equity market is associated with approximately 0.5% increase in TFP. Considering that there was approximately 0.5% global average TFP growth in the sample period and that *Primary*/GDP increased from 0.31% in 1990 to 1.38% in 2014, the portion of TFP explained by the primary equity market is quite significant. The coefficients of the stock market and bank are negative, very small, and mostly insignificant. The result is robust for winsorization of key variables also (columns 5 and 6, Table 4).

[6] We have preferred PCA technique as it uses fewer lags to make valid instruments. However, in some estimations it could not address autocorrelation in composite errors, in such cases, we used the collapsing technique.

Table 4: Estimates with five additional control variables

	Coefficient Estimates for TFP as Dependent Variable					
	5 exogenous variables- not as instruments		5 exogenous variables as instruments		5 exogenous variables as instruments	
	Difference	System	Difference	System	Difference (w*)	System (w*)
Variable	(1)	(2)	(3)	(4)	(5)	(6)
L.TFP[7]	0.0048	0.261**	0.251*	0.242**	0.108	0.132**
Primary	**0.618****	**0.524****	**0.489****	**0.500****	**0.533*****	**0.406****
Stock	-0.0125	-0.00974	-0.0016	-0.0107*	0.00413	-0.00361
Bank	-0.0509**	-0.0113	-0.0059	-0.00286	-0.0218	-0.0103
Inflation	-0.0001	0.000523*	0.000131*	0.000308***	0.000102	0.000176***
Schooling	-0.1240	0.0496**	-0.0465	0.00133	-0.0364	0.000534
Expense	0.0897	-0.0532	-0.435***	-0.0599	-0.444***	-0.0166
FDI	-0.0441	0.0282	-0.0131	0.00947	-0.0126	0.00535
Trade	0.173**	-0.0116	-0.0203	-0.00402	-0.016	-0.000186
Year	-0.147*	-0.0285	-0.0326	-0.0221	-0.0359	-0.0318
Constant		55.84		46.18		64.82
Observations	1736	1815	1736	1815	1736	1815
No. of countries	79	79	79	79	79	79
No. of instruments	68	66	73	71	68	72
AR2	0.31	0.357	0.562	0.4	0.111	0.106
Hansen-J (p val)	0.128	0.184	0.309	0.279	0.24	0.411

Note: *** implies significant at 1%; ** implies significant at 5%; * implies significant at 10%; w* winsorized data

In our final analysis, we have not included the five assumed exogenous variables (inflation, schooling, FDI, government expenditure, external trade) in Andriansyah and Messinis (2014) as instrument or control variables for the following reasons. (1) The results (columns 3 and 4 of Table 4) suggest that when lag-TFP is a control variable in the model and those five exogenous variables are used as instruments for the endogenous independent variables, the addition of the five assumed exogenous variables as control variables in our estimated model gives almost the same estimation for the parameters of our key variables (primary equity market, stock market, and bank) as the result we get without adding those five variables in the model. (2) Further analysis suggests that adding the five assumed exogenous variables (inflation, schooling, FDI, government expenditure, external trade) as instruments for the endogenous variables also shows little effect on the parameter estimates of our key model's independent variables. Panel IV regression[8] suggests that the five exogenous variables as instruments are weak instruments. Including them in the model only reduces the sample size (from 87 to 79) and reduces the degrees of freedom, with no effect on the estimates. These five variables are exogenous by assumption, but Andriansyah and Messinis (2014) argue that they might be endogenous as well with economic growth. (3) The purpose of GMM is to obtain valid instruments from the

[7] L.variable represents the lag value of that variable

[8] The results of panel instrument variables are not reported for brevity. However, they can be provided on demand.

lagged value of variables and to provide unbiased consistent estimators when the other valid exogenous instruments are not available.

Considering the above issues regarding the five additional control variables, we estimated the parameters of our key variables without them. The results from difference GMM are presented in Table 5.

Table 5: Primary–TFP relationship (difference GMM)

	TFP Growth (Coefficient Estimates and Significance)		
Variable	(1)	(2)	(3)
L.TFP	0.256***	0.193*	0.265***
Primary	0.608**	0.505**	0.509**
L.Primary			0.330***
Stock	-0.0108	-0.012*	0.00106
L.Stock			-0.025***
Bank	0.00112	-0.013	-0.00065
L.Bank			-0.0162
Dummy		-1.34**	
Primary*Dummy		0.0238	
Year	-0.0665*	0.011	-0.00133
Observations	1,940	1,940	1,940
No. of countries	87	87	87
No. of instruments	70	70	71
AR2	0.963	0.812	0.726
Hansen-J (p val)	0.14	0.111	0.128

Note: *** implies significant at 1%; ** implies significant at 5%; * implies significant at 10%. Dummy takes the value of 1 in the post 2008 period.

The results (column 1 in Table 5) suggest that excluding the five additional control variables has no impact on the estimation. In addition, the sample size has increased. The results suggest that the primary equity market has a positive impact on TFP (positive 0.5–0.6% growth in TFP for 1% increase in primary equity market/GDP ratio) at the 5% significance level. The impact of Bank and Stock is very small in comparison to the primary equity market and is insignificant.

Hypothesis 2 was tested by estimating coefficients of the equation 6. Breitenlechner et al. (2015) report that the association of Bank and Stock with economic growth has reduced due to economic shocks. We examined the impact of the 2008 financial crisis on the *Primary–TFP* relationship. The interaction of primary equity markets with a dummy for post 2008 (column 2 in Table 5) shows no significant change in the impact of the primary equity market (a positive sign). The dummy is significantly negative, showing that though the TFP growth rate has come down post 2008, the association of the primary equity market with TFP has not weakened after the 2008 economic shock. Further, we included one lag of all the explanatory variables in the model (the rational distributed lag approach) to examine the lag effect. The result (column 3 in Table 5) shows that both contemporary and lag parameters of the primary equity market are significant and positive.

Table 6: Primary–TFP relationship (system GMM)

	TFP			
Variable	(1)	(2) (w#)	(3)	(4)
L.TFP	0.364***	0.0879	0.363***	0.373***
Primary	0.452**	0.554***	0.450**	0.499*
Stock	-0.00697*	-0.00442	-0.0068*	-0.0076*
Bank	-0.00691	-0.00905	-0.0063	-0.00567
Dummy Income UM or H			-0.188	
Dummy Income L or LM				0.424
Year	-0.035***	-0.048***	-0.034**	-0.035**
Constant	70.99***	97.25***	68.78**	69.31**
Observations	2,027	2027	2,027	2,027
No. of countries	87	87	87	87
No. of instruments	68	82	68	68
AR2	0.732	0.205	0.731	0.734
Hansen-J (p val)	0.254	0.325	0.227	0.19

Note: *** implies significant at 1%; ** implies significant at 5%; * implies significant at 10%; w# implies estimates with data of explanatory variable winsorized at 5%

System GMM is argued to be more efficient and robust because it provides more instruments and covers the random-walk-like property in regressors. The results from System GMM are presented in Table 6. The estimates for the parameters of the primary equity market from system GMM (Table 6) are similar to the estimates from difference GMM, showing the robustness of the result. We also used winsorized data (column 2 of Table 6) and the estimates are similar. The average primary equity market impact on TFP growth is positive at around 0.5%. In addition, the impact of the primary equity market is many times more than the impact of other financial market variables.

7.1. Impact of income level on Primary–TFP relationship

Hypothesis 3 was tested by estimating coefficients of the equation 7. Classical growth theories argue that TFP is a function of only innovation absorption. The Schumpeter theory argues that entrepreneurial credit contributes to innovation absorption. Thus, the role of entrepreneurial finance in TFP is claimed in the theory. Arguably, any other factor that has no role in innovation should not have an impact on TFP.

Economic theories and the literature have maintained varying relationships of entrepreneurial finance and economic growth with income level (Schumpeter, 1911; Mckinnon, 1973). It is argued that the more developed a country, the closer it is to the efficient financial market assumptions of classical economic theories and the better its social infrastructure and institutional development. We, therefore, examined the arguments for different finance–growth relationships based on income level in the case of the Primary–TFP relationship. We did this by including the

interaction term of the primary equity market variable with income level. We added dummies for three income levels (LM, UM, and H[9] categories as per the classification of countries provided by the World Bank).

Table 7: Impact of income level on Primary–TFP relationship (difference GMM)

	TFP			
Variable	(1)	(2)	(3)	(4)
L.TFP	0.278***	0.267***	0.276***	0.265***
Primary	0.553**	0.488**	0.486**	0.851**
Stock	-0.0118	-0.0119*	-0.0106	-0.0112
Bank	0.00463	0.00398	0.0013	0.00159
Primary*Dummy Income L	-0.452			
Primary*Dummy Income LM		0.412		
Primary*Dummy Income UM			0.545	
Primary*Dummy Income H				-0.414
Year	-0.0441	-0.039	-0.0375	-0.0344
Observations	1,940	1,940	1,940	1,940
No. of countries	87	87	87	87
No. of instruments	72	72	72	72
AR2	0.917	0.904	0.973	0.958
Hansen-J (p val)	0.151	0.161	0.164	0.155

Note: *** implies significant at 1%; ** implies significant at 5%; * implies significant at 10%

The interaction of the primary equity market with the income level dummy (Table 7, difference GMM) also shows no significant impact of income level on the primary equity market–TFP relationship. However, high negative point estimates for the Primary*H income category interaction (insignificant) and higher positive significant point estimates for the lower income category (countries not in the H category) imply that the primary equity market–TFP relationship is stronger in lower-income categories (column 4, Table 7), as argued in Mckinnon (1973).

The system GMM output (Table 8) also confirms that the primary equity market–TFP relationship is not affected by the income level of economies. The coefficient of the interaction term with income level is insignificant with any income dummy. Overall, the results suggest that income level does not have any significant impact on the primary equity market–TFP relationship. However, the relationship is stronger in LM and UM economies and the relationship in L countries is weaker, possibly due to poor social and institutional infrastructure.

For robustness, we examined the Primary–TFP relationship using winsorized data and obtained similar estimates (columns 1 and 2 of Table 9) with higher significance. This shows that the relationship is free from an outlier

[9] LM means lower middle income countries, UM means upper middle income countries and H implies Higher income countries as defined in World Bank classification of countries

effect. Changing the control variable from lag-TFP to log-GDP (column 3, Table 9) gives similar Primary–TFP relationship estimates.

Table 8: Impact of income level on Primary–TFP relationship (system GMM)

	TFP			
Variable	(1)	(2)	(3)	(4)
L.TFP	0.368***	0.349***	0.363***	0.362***
Primary	0.466**	0.405**	0.462**	0.576**
Stock	-0.00729*	-0.00561	-0.00717*	-0.00612
Bank	-0.00626	-0.00761	-0.00635	-0.00726
Primary*Dummy Income L	-0.292			
Primary*Dummy Income LM		0.371		
Primary*Dummy Income UM			-0.0509	
Primary*Dummy Income H				-0.161
Year	-0.0366***	-0.0349**	-0.0369***	-0.0336**
Constant	73.57***	70.39**	74.22***	67.72***
Observations	2,027	2,027	2,027	2,027
No. of countries	87	87	87	87
No. of instruments	69	69	69	69
AR2	0.765	0.815	0.731	0.733
Hansen-J (p val)	0.215	0.228	0.243	0.243

Note: *** implies significant at 1%; ** implies significant at 5%; * implies significant at 10%

Table 9: Primary–TFP relationship (winsorized data)

	TFP		
Variable	(1)	(2)	(3)
L.TFP	**0.140****	**0.136***	
L.Log GDP			**-4.135*****
Primary	0.427***	**0.503*****	0.456**
Stock	-1.33E-02	-0.0041	-0.00504
Bank	-7.21E-05	-0.00999	-0.00343
Year	-0.0499*	-0.0513*	0.206***
Observations	1,940	1,940	1,940
No. of countries	87	87	87
No. of instruments	86	85	74
AR2	0.403	0.364	0.171
Hansen-J (p val)	0.4	0.392	0.163

Note: *** implies significant at 1%; ** implies significant at 5%; * implies significant at 10%

7.2. Supply-leading or demand-following hypothesis

Hypothesis 4 was tested by estimating coefficients of the equation 4 and equation 8 by adding lagged variables of the key explanatory variables (*Primary, STOCK, BANK*) in the equation as explanatory variables. There is an argument over whether the financial market and economic growth relationship is supply leading or demand following (Patrick

1966; Andriansyah and Messinis, 2014). The results from previous research on the stock market–growth and bank–growth relationships are mixed. Lee (2012) showed that a finance market leads to economic growth.

We examined the Primary–TFP relationship using the RDL (rational distributed lag) approach by including the lag of the dependent variable and regressors. The results are presented in Table 10. These suggest that the primary equity market (both contemporary and lag) has a positive impact on TFP growth. TFP growth does not have an impact on the primary equity market (system GMM) even at lags. The results support the supply-leading argument in the case of the *Primary–TFP* relationship, as the direction of the relationship is from Primary to TFP growth.

Table 10: Supply-leading or demand-following arguments (level variables)

Difference GMM Supply Leading at Levels				**System GMM Supply Leading at Levels**	
	TFP	**Primary**		**TFP**	**Primary**
Variable	(1)	(2)		(3)	(4)
TFP Growth		0.0767*			0.0677
L.TFP	0.265***	-0.0249		0.373***	-0.0926
Primary	0.509**			0.346*	
L.Primary	0.330***	-0.192***		-0.0518	0.158*
Stock	0.00106	0.0289***		0.0126**	0.0308***
L.Stock	-0.0253***	-0.00133		-0.0172***	-0.0125***
Bank	-0.000653	-0.00225		-0.0151	0.0121
L.Bank	-0.0162	0.00285		0.0121	-0.00769
Year	-0.00133	0.00341		-0.0365***	-0.00519
Constant				73.31***	10.63
Observations	1,940	1,940		2,027	2,027
No. of countries	87	87		87	87
No. of instruments	71	71		68	67
AR2	0.726	0.59		0.688	0.06
Hansen-J (p val)	0.128	0.446		0.198	0.417

Note: *** implies significant at 1%; ** implies significant at 5%; * implies significant at 10%

7.2.1. Supply-leading or demand-following hypothesis: Differenced variables

Hypothesis 4 was also tested by estimating coefficients of equation 9. We tested the structural relationship between the all the key variables (*TFP, Primary, STOCK, BANK*) in differenced variables following Andriansyah and Messinis (2014). We estimated the relationship using the ARDL approach (following Andriansyah and Messinis, 2014) and the two-step GMM panel estimation technique (both difference and system). The results of estimates for the system of equations (ARDL) are presented in Table 11.

Table 11: Structural relationship of finance–growth

	D.TFP		D.Primary		D.Stock		D.Bank	
Variable	Difference	System	Difference	System	Difference	System	Difference	System
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D.TFP[10]			0.0990**	0.136**	-0.472	0.0343	-0.515***	-1.159***
LD.TFP[11]	-0.213*	-0.262***	-0.0107	0.0312	-0.271	-0.0325	-0.232*	-0.293**
LD.Primary	0.831***	0.693***	-0.468***	-0.524***	7.622***	8.312***	0.436	1.563***
D.Primary	0.577**	0.545***			10.23***	12.54***	-0.0706	1.202**
LD.Stock	-0.0216***	-0.0203*	-0.00281	-0.00406	-0.0527	-0.00919	0.00672	-0.0511**
D.Stock	-0.00778	0.000498	0.0293***	0.024***			0.0198	-0.00552
LD.Bank	0.0147	0.0433	0.0377*	0.0212	0.085	0.0361	-0.0577	0.126*
D.Bank	-0.0797**	-0.168***	-0.00165	0.0362*	0.199	-0.0202		
Year	-0.0356*	-0.0335***	0.00435	0.00419	-0.154**	-0.109**	-0.0835**	-0.0532**
Constant		67.34***		-8.454		218.4**		107.7**
Observations	1,853	1,940	1,853	1,940	1,853	1,940	1,853	1,940
No. of countries	87	87	87	87	87	87	87	87
No. of instruments	84	82		82		82		82
AR2	0.24	0.114	0.386	0.52	0.091	0.165	0.434	0.899
Hansen-J (pval)	0.3	0.318	0.459	0.425	0.531	0.219	0.313	0.631

Note: *** implies significant at 1%; ** implies significant at 5%; * implies significant at 10%

7.3. Causality test: Panel vector autoregression

Hypothesis 5 was tested using Panel VAR test. In addition to testing the supply-leading argument using the system of equations (Table 10), we carried out a granger causality test between TFP and the financial market by using panel VAR. We applied first-order panel VAR in levels (because of no unit roots) on the data using 1 to 3 lags of the endogenous variables as instruments and inflation, schooling, expenditure, FDI and trade as the exogenous variables for control. The results are shown in Table 12. AR and Hansen-J tests suggested that our instruments are valid.

Table 12: Panel VAR on *TFP–Primary* relationship

	TFP	Primary	Stock	Bank
Variable	(1)	(2)	(3)	(4)
L.TFP	0.0453	-0.0426	-0.62	0.156
L.Primary	0.425***	-0.258**	1.746	0.548
L.Stock	-0.0237***	0.0132***	0.542***	-0.0122
L.Bank	-0.00555	0.0143	0.487**	0.601***
Year	-0.023	0.00256	-0.0437	0.753**
Observations	1,940	1,940	1,940	1,940
No. of countries	87	87	87	87
Hansen-J (P-value)	0.357	0.528	0.39	0.399
AR(2)	0.249	0.227	0.098	0.705

Note: *** implies significant at 1%; ** implies significant at 5%; * implies significant at 10%

[10] D.variable represents differenced variables i.e., the difference of that variable with its own one period lag
[11] LD.variable represents lag of differenced variables

All variables are significantly and positively associated with their own lagged value. The panel VAR result confirms that causation is from the primary equity market to TFP and not the other way round. The result supports the argument of the Schumpeter model (1911). It also shows that out of the three financial market variables, only the primary equity market has a positive effect on TFP in the next period. The result of causality from the primary equity market to TFP growth is robust.

7.4. Cointegration test

Hypothesis 6 was tested by using Pedroni Cointegration test. Previous tests are estimations on levels because no unit root was found. The power of the Fisher-type unit-root test is argued to be higher (Baltagi, 2008). Sjo (2010) argues that rejection of the unit-root test may not mean an I(0) series. In addition, sometimes the test may wrongly reject it even when there is a unit root in the data (Type-I error). Considering the above arguments, we tested for cointegration even when the unit-root test was rejected. We employed the panel cointegration test developed by Pedroni (1999) with an intercept, trend, and lag-select[12] (hqic). The result is presented in Table 13.

Table 13: Cointegration test on TFP–Primary relationship

	Panel Statistics				**Group Statistics**		
Dependent Variable	V	rho	t	adf	rho	t	adf
TFP	2.84	-5.535***	-21.05***	-11.75***	-2.648***	-22.92***	-8.981***
Primary	2.327	-8.384***	-26.08***	-18.52***	-5.284***	-27.9***	-18.03***
STOCK	-0.4377	1.543	-4.418***	1.054	4.304	-3.631***	2.674
BANK	-4.541***	6.308	3.179	6.527	8.554	4.107	5.724

Note: *** implies significant at 1%; ** implies significant at 5%; * implies significant at 10%

The Pedroni cointegration test suggests that the null hypothesis of no cointegration is rejected by six test statistics for both TFP and Primary as independent variables. This shows that TFP has a long-run relationship with the *Primary* market.

The AR and Hansen-J tests signal the acceptability of our model. The results suggest that out of three components of the financial market, only change in the primary equity market significantly and positively impacts TFP growth in the subsequent period. TFP has a contemporary positive and significant effect on the primary equity market, but no positive effect in the subsequent period. Hence, the supply-leading hypothesis from the primary equity market to TFP is established for the differenced variables also. This result further supports the long-run relationship

[12] Lag-select(string) specifies the criterion used to select lag length in ADF (augmented Dickey Fuller) regressions. The string can be AIC(default), BIC or HQIC

between the primary equity market and TFP and causation from the primary equity market to TFP growth, as argued in Schumpeter (1911).

7.5. Robustness of results

We have tried various models[13] to examine the primary equity market–TFP relationship, using dummies, interaction with dummies, including lag, estimating for broken periods, and using winsorized data. We observed a similar significant Primary–TFP relationship in every case (winsorization actually increased the significance). Dropping some other variables from the model, though, does not change the relationship for the primary equity market, and is not preferred as it creates modeling issues and estimates are not reliable, because financial markets have some collinearity. Stock and Bank are correlated with lagged GDP and dropping them, though it does not affect the primary equity market coefficient, increases the parameter of the lagged dependent variable to more than one, which is not acceptable.

8. New *Primary–TFP–Growth* puzzle: Path and goal mismatch with Schumpeter model

Vinod and Ganesh (2017) showed that the primary equity market has a high and significant impact on economic growth in non-H economies, but an insignificant impact in H economies. Combined with that finding, the results of this study threw up a puzzle. The puzzle is that if the primary equity market plays a high and significant role in H economies (an equal role in all income groups), then why is the economic growth impact of the primary equity market very weak in H economies? Why do primary equity markets have a highly significant and positive impact on TFP in both H economies and non-H economies, but little growth impact in H economies and a very high impact in non-H economies?

8.1. Discussion of the puzzle

We have tried to develop some insights that may be helpful in understanding the phenomena. We analyzed the puzzle in three steps. First, we discuss theory to explain the phenomena; then we present the pattern of data to support our arguments; subsequently we use the GMM estimation technique to establish our argument.

[13] Some results are not reported for brevity. However, they can be provided on demand.

8.1.1. Views from growth theories: Is there a Primary–TFP–Growth puzzle?

The question we examined first was whether it is a puzzle that in H economies, the primary equity market is strongly associated with TFP and weakly associated with GDP/capita. Are the empirical findings in conflict with Schumpeter (1911) and growth theory? We argue that they are not. In fact, when we explored the puzzle more deeply, the findings provided interesting pieces of information to understand neoclassical growth theories and the Schumpeter model in an integrated framework.

There is a difference between TFP data (Solow residual) and factor productivity as defined in the Schumpeter model. Schumpeter (1911) considered the contribution of all five kinds of innovations as factor productivity. In the Solow model of growth, technology (other than capital and labor) is exogenous. Because finance plays a role through technological development (Schumpeter, 1911), finance is also exogenous in classical growth models. Endogenous growth theories (Romer, 1990) made technology endogenous, and then finance found a place in growth theory (Pagano, 1993). Combining classical growth theories, endogenous growth theories, and the Schumpeter model, finance is argued to have a role in factor productivity growth. However, for non-TFP (capital accumulation–driven) growth, by definition, classical theory does not consider the role of finance. Thus, in classical theories, finance has a role in TFP (Solow residuals). However, finance has a role in total growth, as argued in the endogenous growth model with another set of assumptions (Mckinnon, 1973; Pagano, 1993). This suggests that we should see the relationship of the primary equity market with TFP growth and non-TFP growth separately in different income groups of countries.

There are measurement issues. The TFP data used in the estimation process are the Solow residuals; that is, after factoring in the contribution of capital and labor growth. If we compare theory and calculation, while the Schumpeter and classical models talked about the full contribution of qualitative change (absorption of innovation), the TFP calculation or Solow residuals may not represent an accurate calculation of technological development due to assumptions made in the calculation. For example, we assume constant returns to scale for all L, LM, UM, and H economies, even when there may be some difference in returns to scale in different economies (due to the openness of the economy). The difference in actual returns to scale from constant returns to scale in a country may have some impact on TFP estimates and hence on the findings. Because ideas have an increasing return to scale, more innovation-driven economies will have higher returns to scale than less innovation-driven economies in an open market. This results in over- and under-estimation of TFP in some economies.

8.1.2. TFP-driven growth vs. non-TFP growth

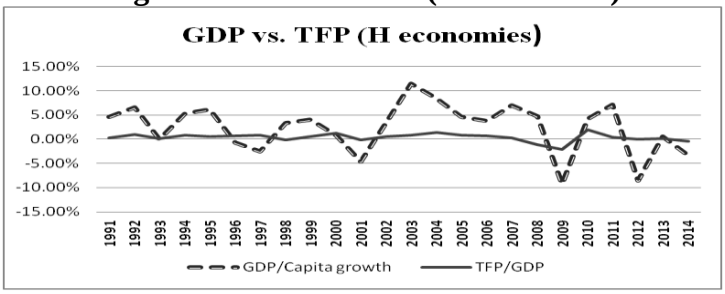
There are various issues that we consider for a possible explanation of the puzzle discussed above. The first issue is related to the measurement of TFP, which we discussed in the previous section. The second issue is that the economic growth drivers in H and non-H economies may be different. These differences may be the cause behind the variation in the relationship between the primary equity market and GDP/capita among different income groups of countries. Considering this second issue, let us first look at the graphical pattern of data on H and non-H economies.

8.1.3. Pattern of GDP–TFP relationship in data

Year-wise totals of *GDP*, *Primary*, and *TFP* for all countries in the sample are presented in Figures 1, 2, 3, and 4. To see the relationship between variables closely, Figures 1 and 2 are compressed/scaled by suitable factors. We can see from Figure 1 that average *TFP* and *GDP/capita* move closely together. The same can be said about the *Primary–TFP* relationship from Figure 2.

Theoretically, total growth should be higher than *TFP* in economies with positive growth in capital and labor, which is visible in the graph area above the TFP curve. However, we see that the GDP growth curve is crossing the TFP curve many times (Figure 1). The period when GDP growth is lower than TFP growth is the period of economic shock. This also shows that a shock affects non-TFP growth much more than GDP growth. TFP is positive for many years, even when total growth is negative. Overall, we see (Figure 1) that during the sample period, the GDP/capita growth rate had gone below TFP/*Primary* four times (twice after the dot.com bubble).

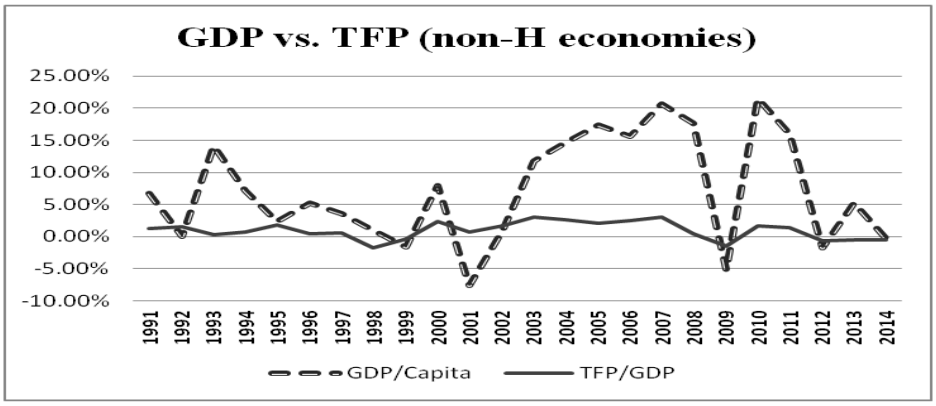
Figure 3: GDP vs. TFP (H economies)



When we look at this relationship in H and non-H economies (Figures 3 and 4), we see that GDP per capita growth is more volatile around the TFP growth curve in H economies than in non-H economies. In non-H economies, the total growth rate is mostly above TFP, and the size of any deviation below the TFP curve is smaller. This shows that non-TFP growth is much more volatile in H economics than it is in non-H economies, suggesting that the growth

drivers of non-TFP growth in H economies and non-H economies are different. It further suggests that we should look at the relationship of the primary equity market with non-TFP growth separately for H and non-H economies.

Figure 4: GDP vs. TFP (non-H economies)



8.2. *Primary–TFP–Growth* puzzle: Data analysis (GMM)

The puzzle was examined by testing Hypothesis 7 using equation 5. We estimated parameters of equation (5) using GMM on the same panel data set. Estimating the impact of the primary equity market on non-TFP growth by taking 'GDP growth–TFP' as the dependent variable could overestimate the impact of the primary equity market, because TFP growth may also affect economic growth due to the spill-over effect.[14] Also, the independent variable in that case will be percentage growth and hence the parameter of Primary will not measure the impact on economic growth, but rather changes in the non-TFP economic growth rate. In such a case, the estimated β in this model will not be comparable with the β in previous models.

Summary statistics showing differences in H and non-H economies are presented in Table 14.

Table 14: TFP and non-TFP growth summary

Period 1994–2014		TFP Growth	GDP/Capita Growth	Primary equity market/GDP
H economies	Average	0.30	2.38	1.75
	Std. dev	3.066	10.066	2.631
Non-H economies	Average	0.72	7.17	1.14
	Std. dev	3.824	18.673	1.270

[14] Higher TFP growth (higher technological absorption) may also have an impact on capital and labor accumulation, leading to higher economic growth.

The results of the difference GMM estimation are presented in Table 15. We see that a 1% increase in TFP has an impact on growth in GDP/capita of 3.39% in non-H countries, and 1.95% in H countries. In addition, controlling for the contribution of *TFP*, *Primary* market growth brings 3.15% growth in GDP/capita in non-H countries, but primary equity market growth has no significant impact on GDP/capita in H economies. This shows that the primary equity market causes higher growth in non-H economies via two routes: the TFP and the non-TFP (factor accumulation) routes. In contrast, in H economies, the primary equity market brings growth only through the TFP route.

Table 15: GMM output on *Growth–Primary–TFP* relationship

Variable	**Non-H Economies**	**H Economies**
Log GDP/capita	(1)	(2)
L.Log GDP per capita	1.039***	0.7578***
Primary	**0.0315***	-0.010
Stock	0.000671	0.0002
Bank	-0.00628*	0.0015**
TFP Growth	**0.0339*****	**0.0195****
Year	0.0064	0.0049
No. of observations	1,102	838
No. of countries	59	49
No. of instruments	51	45
AR3	0.862	0.105
Hansen-J (p val)	0.306	0.235

Note: *** implies significant at 1%; ** implies significant at 5%; * implies significant at 10%

9. Summary and conclusion

The theoretical and empirical literature supports the positive role of entrepreneurial finance in TFP growth, taking banks, and the stock market as components of the financial market. Schumpeter's economic model argues that entrepreneurship finance brings about a qualitative change in the economy and factor productivity. Several researchers have examined the role of banks and the stock market (as representative of finance) in productivity growth. However, the role of the primary equity market has not been examined. The literature has argued that the primary equity market is associated with financing for innovation-driven entrepreneurs. Following this, we examined the role of the primary equity market in factor productivity growth. We also examined the role of income level in the primary equity market–TFP relationship. We examined these relationships using various robustness checks.

All the seven Hypotheses derived from the theory are supported empirically. These finding are especially important after the study of Andriansyah and Messinis (2014) who found that the Primary-Growth relationship was

significant. We found that the primary equity market significantly and positively impacts TFP growth in all income groups of economies. The estimates were found to be robust to several variations in the model, estimation techniques, adding and dropping some variables (economic growth, interaction terms), and winsorization. The role of the primary equity market in TFP was not affected by income level (compatible with the argument of growth theory). The relationship of the primary equity market with TFP was also unaffected by the post-2008 economic crisis.

We also examined causality using the ARDL approach and panel VAR. We found that causality runs from the primary equity market to TFP (the Schumpeter model) and not the other way round. We found that TFP and Primary are cointegrated. We also checked robustness using differenced variables. Primary was found to affect TFP, Secondary, and Bank positively and significantly. We also estimated the LRP of the primary equity market on TFP and found that a 1% permanent increase in TFP brought more than a 100% increase in TFP.

Overall, the results support the Schumpeter model of economic development as well as classical growth theory (that TFP is impacted by innovation). In addition, after taking the primary equity market into account, the remaining two financial market variables, Stock and Bank, were found to have less explanatory power. Thus, while our results provide support to the finance–growth theory, they also suggest that we should give more weight to the primary equity market as a driver of growth and productivity.

Our findings also created a puzzle regarding the Primary–TFP–Growth path, as described in Schumpeter (1911). Further analysis showed that the primary equity market–TFP–economic development path, as argued in Schumpeter (1911), is not deviated from. The primary equity market explains TFP in both H and non-H economies. However, the primary equity market also explains factor accumulation growth in non-H economies (following Mckinnon, 1973) but not in H economies (following classical theory). Classical growth theory attributes little role to *Primary* in the case of non-TFP growth in H economies, where the financial market is more competitive and efficient. However, in developing economies, the Mckinnon model explains the growth role of the *Primary* market. In H economies, (1) non-TFP growth has no association with the primary equity market; (2) non-TFP growth is larger than TFP growth; and (3) non-TFP growth is very volatile. Therefore, the *Primary*–total growth relationship in H economies is very weak, even though the *Primary*–TFP relationship is strong.

Andriansyah and Messinis (2014) found no relationship between *Primary* and total economic growth in their data set of 28 countries. Our findings do not counter their findings but rather expand them. The findings of Andriansyah and Messinis (2014) could be due to their data set of high-income economies. We also found no

relationship between *Primary* and total economic growth in high-income countries. We did, however, find a strong relationship in the case of *Primary*–TFP in H economies. Andriansyah and Messinis (2014) suggest that *Primary* may be affecting growth through some other route. Our study worked on this and showed that *Primary* affects growth through the TFP route in all economies, and through the non-TFP route also in lower-income economies.

10. Policy implications

Our findings shed new light on the primary equity market and TFP relationship and give policy-relevant insights. *Primary equity market*–TFP is a long-run relationship and an *primary equity market development* causes TFP growth. The findings suggest that, for long-run qualitative growth in the economy, policymakers should increase the primary equity market/GDP ratio. Policymakers should bring about institutional and business environment reforms that promote the growth of the primary equity market (Doidge, 2013). In addition, policymakers can use primary equity market development as a reliable and measurable indicator of the impact of various policies designed for future economic growth and development. Primary equity market development can also be used by portfolio managers to understand the growth prospectus in a country.

11. Limitations of the study and future research directions

The main limitation of the study is data related. The factor productivity data were estimated indirectly from residuals based on the assumptions of growth theory. Our sample excluded some countries from the data set. Data issues, the estimation technique, and the assumption of linearity in the model may have had their effects.

The findings are suggestive of new research directions. This research could be further extended to the determinants of primary equity market growth. Doidge (2013) argued for the role of institutions in primary equity market development. However, this study did not include institutions in the model since we followed Andriansyah and Messinis's (2014) model. We assumed that the role of institutions in TFP is controlled through lag-TFP. The role of institutions in the primary equity market–TFP relationship could be studied separately. In addition, our study is a cross-country panel data study; there may be vast differences in the institutional characteristics of different countries and their impact. Since longer time series are now available, time series data analysis for individual countries could provide new insights on the institutional impact in various countries.

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