# Recalibrating Investment Return in the Presence of Capital Adjustment Friction

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**Abstract**

Following the influential paper by Banerjee and Duflo (2007), the body of research that analyse the effect of misallocation and capital market imperfection using firm/plant-level data has been growing within the growth literature. This paper contributes to this strand of research by measuring the return loss arising from the friction in the capital accumulation process. Using the model of capital adjustment friction from the investment theory literature, I show that the friction potentially drives not only the cross-country heterogeneity but also the enormous heterogeneity in investment return observed within a single economy. This is particularly true in emerging countries where high capital adjustment friction often leads to lower investment return relative to developed peers, despite their high marginal product of capital. In the counter-factual exercise, I show that moving to the US level of efficiency in the capital adjustment process can potentially increase the investment return in India by up to 15%

*Keywords:* Capital Market Frictions, Investment Return, Marginal Product of Capital

## 1. Introduction

Since the seminal paper by Lucas(1990), neoclassical model has been used as a benchmark model in explaining the cross-country difference in the factor rate of return in growth literature. Assuming perfect factor market, and identical technology across countries, the model implies decreasing return to capital with increase in output per capita. However, in their heavily cited paper, Banerjee and Duflo (2007) show an "extensive evidence, culled from the micro-development literature, demonstrating that the assumption of optimal resource allocation fails radically. The key fact is the enormous heterogeneity of rates of return to the same factor within a single economy, a heterogeneity that dwarfs the cross country heterogeneity in the economy wide average return." This poses a problem for traditional aggregate approach in development literature. As stated in Fisher(1969), the "production function is not a description of what output can be produced from given inputs. Rather, the production function describes the maximum level of output that can be achieved if the given inputs are efficiently employed". Thus, if there is capital market inefficiency within the economy, such that output generated is not the maximum given the factor inputs, then using marginal product of capital (MPK) equation derived from aggregate production function can lead to a specification error.

This evidence of within country heterogeneity is leading to a growing body of research within the growth literature that analyse the effect of misallocation and capital market imperfection using firm and plant-level data. Some of the prominent work in this field include Hsieh & Klenow (2008), Alfero, et al (2008), and Bartelsman, et al (2006), which use plant/industry data to analyse the effect of market imperfection on TFP and income difference across countries. Using US distribution of firm as the benchmark, Hsieh & Klenow (2008), and Alfero, et al (2008) attempt to measure the magnitude of loss from misallocation in emerging countries. This paper contributes to this strand of literature by analysing the impact of capital adjustment friction on investment return.

Neoclassical model assumes zero friction in the capital accumulation process and thus, return on investment is set equal to MPK minus depreciation rate. Indeed if MPK difference across countries is anywhere close to what is implied by the standard neoclassical model (over fifty-fold difference), capital adjustment cost is unlikely to have a meaningful impact on the cross-country investment return patterns. However, Caselli & Feyrer (2007) show that MPK is in fact equalized across countries when controlling for the cross-country price difference. In this case, the capital adjustment cost can play an important role in explaining the cross-country investment return patterns. However, thus far, friction in the capital accumulation process (henceforth referred as capital adjustment friction), which is commonly used in investment literature[1], has been largely ignored in cross country aggregate capital return comparison.[2] Gourinchas and Jeanne (2009) does consider the impact of "capital wedge" from the market distortion in their aggregate model, but still keeps the perfect capital mobility assumption so that wedge adjusted return equals the world interest rate. This paper instead focus on how the capital friction disrupt the traditional MPK-investment return relationship.

In this paper, I document using the firm level data that the standard linear relationship between MPK and investment return doesn't hold in the empirical data. Contrary to the standard "no arbitrage" assumption, which suggests that investment return and MPK differ only by a small constant, the relationship is highly variable. Not only is the investment return more volatile, but within country distribution is also far wider versus MPK. Based on these observations, I re-calibrate capital accumulation equation with adjustment cost to match the data. I find statistically significant capital adjustment cost even after controlling for time and firm fixed effects. Based on the estimated parameters, I then recalibrate investment return using the model that follows Cochrane (1991). On average, there seems to be relatively large capital adjustment cost in emerging countries compared to developed countries, and in number of years between 1996-2015, this led to higher average investment return in developed countries despite lower average MPK. This suggests that although the

[1]The standard assumption in the investment theory is that there is a significant capital loss in the investment process as resources have to be deviated from its usual production process (ex: workers stop working in the production line while new machines get installed)

[2]Chirinko and Mallick (2008) points out the high adjustment cost, but suggests that this directly impacts the marginal product of capital.

return on installed capital is high in emerging economies, high cost of instalment can potentially erode the capital gain. This result is significant as it questions the validity of MPK as a measure of return when analysing the international capital flow.

Section 2 describes the firm-level data and the methods of measurement used in the paper. In section 3, I empirically document the non-linear relationship between MPK and investment return and introduce the model with capital adjustment cost from the investment theory literature. In section 4, I calibrate the model and measure the investment return based on the estimated parameters. I also run a counter-factual return analysis, assuming all countries have capital instalment technology identical to that in US. I find that investment return in emerging countries significantly increase, topping return in developed countries. In section 5, I conclude.

## 2. Methodology and Data

In this section, I introduce measure of firm-level MPK and return on investment used in the accounting and finance literature. Minor modifications are made to the traditional equation following the example of Fama French (1999) to better align the values with the economic definition of return.

### *2.1. MPK: Return on Asset (ROA)*

ROA is one of the most commonly used meters of firm performance in accounting literature and directly aligns with the traditional MPK definition described in equation (5). It measures capital gain generated from the asset after deducting expenses.

$$r^{ROA}_{f,t,c} = \frac{X_{f,t,c}}{TV_{f,t-1,c}(1+\pi_{c,t})} \tag{1}$$

$X_{f,t,c}$ is the aggregate cash earning (EBITDA) of firm $f$ in country $c$ in year $t$. $TV_{f,t-1,c}$ is the total asset value of firm $f$ in country $c$ at the end of period $t-1$, and is the sum of debt that pays explicit interest (book-value of long-term and short-term debt) and market value of the firm's common stock. $\pi_{c,t}$ is the inflation rate in country $c$ in year $t$. It enters into the equation to control for the effect of inflation. The downside of this estimation method is that it does not adjust for the survivor bias as it only measures the period return of firms present in the sample at time $t$. Thus, this can potentially bias up the return to capital in emerging countries.

### *2.2. Investment Return: Internal rate of return (IRR)*

Under the standard assumption that market value of the firm is equal to the discounted present value of the net future cash flows, one can write:

$$r^{IRR}_{f,c,t} = \frac{X_{f,t,c} - I_{f,t,c} + TV_{f,t,c}}{TV_{f,t-1,c}(1+\pi_{t,c})} - 1 \tag{2}$$

Definition of $X_{f,t,c}$ ,$TV_{f,t-1,c}$, and $\pi_{c,t}$ is identical to that in the previous subsection. $I_{f,t,c}$ is aggregate gross investment by firm $f$ in country $c$ at time $t$, and is the net changes in book value of assets plus depreciation. It essentially measures a period return an investor can expect at the end of period $t$ after investing a \$1 into a firm at the end of the period $t-1$. Note that equation (8) is identical to the equation (7) if $TV_{f,t,c} = TV_{f,t-1,c}(1 + \pi_{t,c}) + I_{f,t,c}$. This is the standard capital accumulation equation[3] with zero depreciation rate.[4]. If there is no friction in the capital market, investment and market value of firm should correspond one-to-one; i.e. a unit change in investment should lead to a unit change in inflation adjusted market value of the firm. Thus I will use $r_{IRR}$ to measure investment return and if traditional capital accumulation equation is correct, the ROA and IRR should be roughly identical over the years.

### *2.3. Firm Level Data: Data Sources and Definitions*

The sample firms used in the analysis are listed firms in MSCI developed and emerging countries. By focusing on the listed firms, I exclude small domestic factories that are prevalent in emerging countries, which often account for low level of aggregate productivity in these countries. In this paper, I also limit my analysis to MSCI emerging and developed countries that have relatively well established stock markets. Some developing countries do not have national stock exchange (ex: Angola, Brunei), and market capitalization in many developing is so small that Worldscope does not carry data on the firms traded on the exchange (ex: Maldives Stock Exchange had only five firms listed as of 2008). Table 1 shows the MSCI list of developed and emerging countries used in the analysis. Printed in red are the countries whose financial data were unavailable until after 1995. Therefore, these countries had to be omitted from the analysis. Taiwan was omitted due to absence of GDP(PPP adjusted, constant international dollar) data.

The estimation period that is used in the paper is 1995-2015. Longer period would be more favorable as it provides more reliable estimates of expected returns minimizing the effect of a periodic shock, but unlike macroeconomic aggregate data, which goes back to mid-1900s, firm level data from emerging countries are often unavailable pre-1995.[5].

Financial and market data used to calculate the return to capital for firms in these countries are obtained from Worldscope Datastream. As stated by Wald (1999) Worldscope "makes several adjustments to the data to make the definitions more comparable to their US counterparts." Thus, Worldscope is particularly appropriate data source for international

[3]The law of motion for capital in the neoclassical theory of investment is: $K_t = (1 - \delta)K_{t-1} + I_t$ such that $K_t$ is capital in period $t$, $I_t$ is investment in period $t$ and $\delta$ is capital depreciation rate.

[4]I do not adjust for depreciation as there is substantial measurement error involved in the estimation process. Refer to Fama French (1999) for details

[5]"Worldscope offers comprehensive annual history from the late 1980s for firms in developed markets, and from the early 1990s for firms in emerging markets."(Thomson Worldscope Fundamentals)

financial data comparison. PCGDP data is from Penn World Table 9.0 and inflation data is from World Bank.

Within each country I exclude firm years with missing market value, book value, or EBIT (earnings before interest and tax). I also remove firm years with negative book value, or negative sales (usually occurs within a year or two before exiting the sample due to technicalities in accounting). Financial sector is excluded in the analysis as the paper focuses on the return from real economy. Standard Industry Classification (SIC) code was used to sort the firms into industries, following the convention of US Securities and Exchange Commission (SEC). After exclusion has been applied, the main analysis uses 291,652 firms years across 43 countries.

## 3. Model and Empirical Analysis

### *3.1. Cross-Country MPK and IRR Paterns*

As stated in the introduction, traditional Neo-Classical model suggests that MPK should trend downward with increase in PCGDP. Data on table 2 does show that the firms in emerging countries have higher MPK compared to their peers in developed countries (except in the years of Asian Financial Crisis), but the magnitude of difference is less than $8\%p$ for all years during the sample period as shown in table 2. This is also portrayed in figure 1, which plots the distribution of returns across countries in 2005. The countries are plotted in the order of increasing PCGDP, and although firms in emerging countries have slightly higher MPK, the value is roughly equalized across countries. This empirical finding is consistent with Caselli & Feyrer (2007) and confirms Lucas' suspicion that actual MPK difference among countries is far less than that suggested by the neoclassical model.

If the standard capital accumulation equation hold, then the IRR plot should show a graph identical to figure 1, shifted down by a constant $\delta$.[6] However, as shown in figure 2, this is clearly not the case. There is a wider cross-country and within country variation in return compared to figure 1. This is further confirmed in table 2, which show that the magnitude of the median IRR difference between developed and emerging countries during the period ranges between $20\%p$ and $0.7\%p$, which is significantly wider than $8\%p$ - $0.09\%p$ range for ROA. Furthermore, for 6 years (2000, 2003, 2004, 2011, 2013, and 2015) in the sample, the median IRR in developed countries is higher than that in emerging countries despite lower MPK.

This empirical result has two implications. It 1) highlights the importance of the capital adjustment cost, and 2) shows the need for investment return measure that accounts for such friction in the capital accumulation process. Thus, in the following subsection, I introduce

[6]The standard estimate of $\delta$ in development literature is 0.06

a model with capital friction and recalibrate the investment return accounting for the loss in the capital adjustment process.

*3.2. Model (Cochrane, 1991)*

In this section, I show a model based on the firm-level profit maximization problem introduced in Cochrane (1991). Consider a population of firms indexed by $i$ in period $t$. Each firm chooses a level of labor($l_{i,t}$), capital($k_{i,t}$) and investment($I_{i,t}$) that maximizes the present value of the all future cash flows

$$\max_{l_{i,t},k_{i,t},I_{i,t}} \sum_{t \geq t_0} \frac{1}{R_{i,t}} (y_{i,t} - I_{i,t} - w_{i,t} l_{i,t}) \tag{3}$$

subject to the following constraints:

$$\text{Production function:} \quad y_{i,t} = f(k_{i,t}, l_{i,t}) \tag{4}$$

$$\text{Capital accumulation:} \quad k_{i,t+1} = g(k_{i,t}, I_{i,t}) \tag{5}$$

$$\text{Borrowing constraint:} \quad k \leq k_{i,t} \tag{6}$$

$$\text{Perfect labor market:} \quad w_{i,t} = w_t \tag{7}$$

$R_{i,t}$ is a cumulative investment return ($R_{i,t} = (1 + r_{i,t})(1 + r_{i,t-1})...(1 + r_{i,t_0})$) such that $r_{i,t}$ is the firm $i$'s investment return in period $t$. The first order condition yields:

$$f_2(k_{i,t}, l_{i,t}) = w_t \tag{8}$$

$$(f_1(k_{i,t}, l_{i,t}) + \frac{g_1(k_{i,t}, I_{i,t})}{g_2(k_{i,t}, I_{i,t})}) g_2(k_{i,t-1}, I_{i,t-1}) = (1 + r_{i,t}) \tag{9}$$

In this paper, I assume that capital accumulation equation is given by $k_{t+1} = Ak_t + BI_t + C(\frac{I_t}{k_t})I_t + D(\frac{I_t}{k_t})^2 I_t$.[7] This will be the standard law of motion for capital if $A = 1 - \delta$, $B = 1$, $C = 0$ and $D = 0$. Note that if the standard law of motion for capital holds, i.e. $k_{i,t+1} = g(k_{i,t}, l_{i,t}) = (1 - \delta)k_t + I_t$, then the equation (9) yields, the standard "no arbitrage" equation ($r_{i,t} = f_1(k_{i,t}, l_{i,t}) - \delta$).

## 4. Capital Adjustment Cost and Re-Calibration of Investment Return

*4.1. Re-Calibration of Investment Return*

To find the investment return, I first run the following linear regression to check for the presence of non-zero capital adjustment cost in each country.

$$k_{i,t,c} = \alpha_{t,c} + \beta^1_{t,c} k_{i,t-1,c} + \beta^2_{t,c} I_{t,c,i} + \beta^3_{t,c} \frac{I_{i,t,c}}{k_{i,t-1,c,}} + \beta^4_{t,c} \frac{I^2_{i,t,c}}{k_{i,t-1,c}} + Firm_{i,t,c} + TimeDummies_t + \epsilon_{i,t,c} \tag{10}$$

[7] standard capital adjustment equation only use quadratic term, but this paper also use cubic term, which is used by Cochrane (1991).

$k_{i,t,c}$ is capital of firm i in country c in period t, which is proxied by $TVi, t, c$, and $I_{i,t,c}$ is an aggregate gross investment of the firm i in country c in period t. This is measured by the change in book value of an asset plus book depreciation as in section 2. $Firm_{t,c,i}$ control for firm fixed effects such as size(book value of asset), equity PBR(ratio of market value of equity and book value of equity), debt-to-equity ratio, and the accounting standard (Dummy for IFRS). Time dummies are added to the regression to control for the time fixed effect.

The regression result is presented in Table 3. The coefficients for I and K are statistically significant in all countries, and coefficient for quadratic and cubic terms are also significant for most countries in the sample. Using the new adjustment equation and the value of $\beta$ that are statistically significant, I re-calibrate the investment return based on eq (9).[8] As portrayed in Figure 3, re-calibrated investment return varies significantly from the simple IRR calculated using eq (2). Table 4 compares the averages of estimated investment return and the IRR for developed and emerging countries over the sample years. As apparent in the data, there is no systematic relationship between the two measure over the years, which suggests that understanding the capital accumulation process is integral in accurate measurement of investment return. Estimated return also suggests that although emerging countries on average have higher return on installed capital (MPK), this doesn't ensure higher investment returns. A significant loss in the instalment process can erode the potential capital gain.

To measure the loss due to excess capital friction in emerging countries, I also re-calibrate the investment return assuming that all countries have the capital instalment technology identical to that in US. The result shown in table 5 is quite surprising as the magnitude of potential gain in emerging countries that can be obtained by reducing the capital adjustment cost is substantial. As shown in column (4), post-1998, emerging countries have higher return in all years except 2008, 2011, and 2013. Figure 4 shows that this adjustment not only increases the median return, but also decrease the within country variation.

## 5. Conclusion

This paper analyse the effect of within country capital accumulation friction using the firm level data. I show that the traditional linear relationship between MPK and investment return doesn't hold, and find that there is a significant capital adjustment cost in most MSCI developed and emerging countries. This leads to a large heterogeneity in the investment return both within and across countries, an observation that is consistent with the findings of Banerjee and Duflo (2005). This result is significant as it questions the validity of MPK as a measure of return when analysing the international capital flow. Firm level data suggests that high capital adjustment cost in emerging countries often leads to

[8]This approach is similar to Chrinko and Mallick 2008), where they apply adjustment cost (calibrated from stock market and firm-level data) to aggregate MPK.

lower investment return relative to developed peers, despite their high marginal product of capital. Although the data on small-size firm is not easily obtainable, this effect should be even larger in a mom-and-pop stores in emerging countries, which employ less capital and labor.

The result presented in the paper thus far is still preliminary. Robustness test should be performed on the result presented thus far as the period of analysis includes Financial Crisis. This issue can potentially be addressed by dividing the analysis period to pre- and post-2006, or by introducing additional control dummy. More research is also needed on 1) how this friction affect the magnitude of investment, and 2) factors that lead to the capital accumulation losses. These analysis will be particularly significant as they can have an important policy implication for the emerging countries. The future research should address these issues and provide a complete micro-based model of the economy that can match the macroeconomic flow data.

## 6. Tables and Figures

Table 1: MSCI list of Developed and Emerging countries as of 2015

| **Developed** | **Emerging** |
|---|---|
| Australia | Bangladesh |
| Austria | Brazil |
| Belgium | Chile |
| Canada | China |
| Denmark | Colombia |
| Finland | Czech Republic |
| France | Egypt |
| Germany | Greece |
| Hong Kong | Hungary |
| Ireland | India |
| Israel | Indonesia |
| Italy | Malaysia |
| Japan | Mexico |
| Netherlands | Peru |
| New Zealand | Philippines |
| Norway | Poland |
| Portugal | Qatar |
| Singapore | Russia |
| Spain | South Africa |
| Sweden | South Korea |
| Switzerland | Taiwan |
| United Kingdom | Thailand |
| United States | Turkey |
| | United Arab EmiraCrotes |

Figure 1: ROA distribution by Country

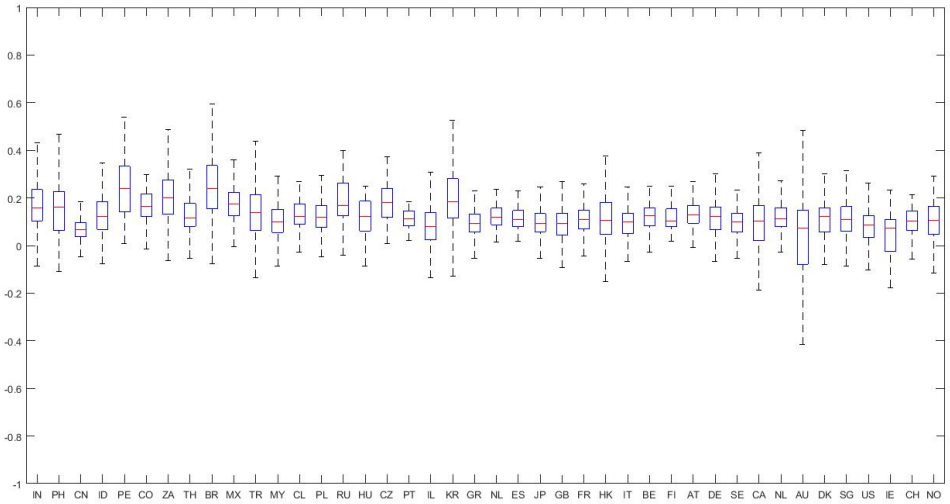

Figure 2: IRR distribution by Country

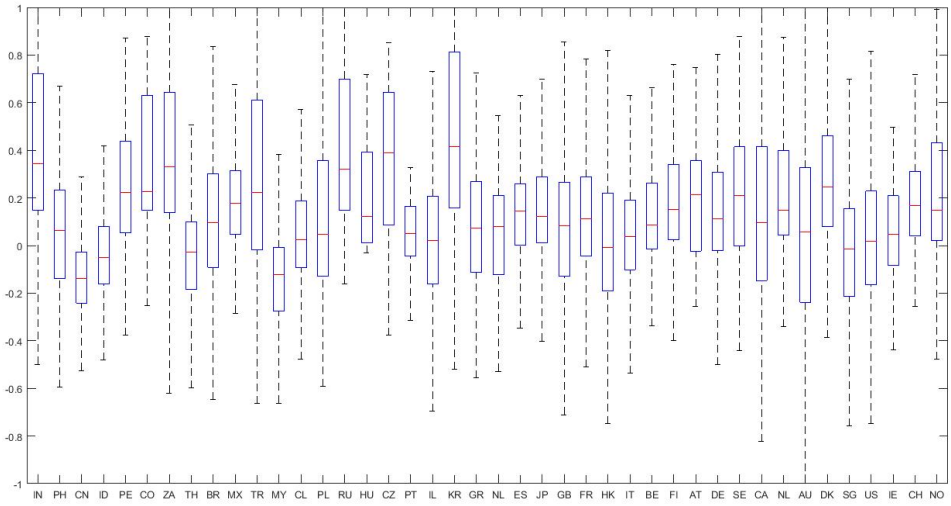

Table 2: ROA and IRR in developed and emerging countries

| | ROA | | | IRR | | |
|---|---|---|---|---|---|---|
| | Developed | Emerging | Diff | Developed | Emerging | Diff |
| 1997 | 0.123 | 0.102 | 0.021 | 0.093 | (0.063) | 0.156 |
| 1998 | 0.128 | 0.114 | 0.015 | 0.009 | (0.205) | 0.214 |
| 1999 | 0.117 | 0.156 | (0.039) | 0.076 | 0.174 | (0.098) |
| 2000 | 0.121 | 0.153 | (0.032) | 0.001 | (0.005) | 0.006 |
| 2001 | 0.104 | 0.167 | (0.063) | (0.020) | 0.032 | (0.052) |
| 2002 | 0.117 | 0.190 | (0.073) | (0.032) | 0.026 | (0.058) |
| 2003 | 0.144 | 0.198 | (0.054) | 0.198 | 0.171 | 0.028 |
| 2004 | 0.134 | 0.190 | (0.056) | 0.189 | 0.141 | 0.047 |
| 2005 | 0.106 | 0.159 | (0.053) | 0.106 | 0.148 | (0.042) |
| 2006 | 0.119 | 0.160 | (0.041) | 0.180 | 0.198 | (0.018) |
| 2007 | 0.110 | 0.147 | (0.037) | 0.083 | 0.222 | (0.139) |
| 2008 | 0.077 | 0.085 | (0.009) | (0.313) | (0.272) | (0.041) |
| 2009 | 0.105 | 0.159 | (0.054) | 0.133 | 0.235 | (0.102) |
| 2010 | 0.108 | 0.140 | (0.033) | 0.108 | 0.161 | (0.053) |
| 2011 | 0.094 | 0.102 | (0.008) | (0.062) | (0.085) | 0.023 |
| 2012 | 0.106 | 0.124 | (0.018) | 0.051 | 0.058 | (0.007) |
| 2013 | 0.101 | 0.102 | (0.001) | 0.153 | 0.013 | 0.141 |
| 2014 | 0.085 | 0.098 | (0.013) | 0.034 | 0.043 | (0.008) |
| 2015 | 0.084 | 0.095 | (0.011) | 0.071 | 0.035 | 0.037 |

Table 3: Beta Coefficients by Country

| | $\beta^1$ | $\beta^2$ | $\beta^3$ | $\beta^4$ |
|---|---|---|---|---|
| AUS | 1.73 *** | 0.874 *** | -0.526 *** | 0.0249 *** |
| AUT | 1.12 *** | 0.82 *** | 1.88 *** | -1.79 *** |
| BEL | 1.27 *** | 0.937 *** | 0.313 | -0.923 *** |
| BRA | 2.68 *** | 0.864 *** | -2.11 *** | 0.556 ** |
| CAN | 1.43 *** | 0.873 *** | -0.028 | -0.002 |
| CHL | 1.62 *** | 0.869 *** | -0.220 | -0.503 *** |
| CHN | 3 *** | 0.832 *** | -1.54 *** | 0.0898 *** |
| COL | 4.37 *** | 0.493 *** | 4.14 *** | -6.65 *** |
| CZR | 1.17 *** | 0.829 *** | 2.85 *** | -1.82 *** |
| DNK | 0.355 ** | 1.17 *** | -1 ** | 0.348 ** |
| FIN | 3.56 *** | 0.782 *** | -3.47 *** | 0.807 |
| FRA | 0.913 *** | 0.881 *** | 2.15 *** | -0.674 *** |
| DEU | 1.83 *** | 0.886 *** | -1.44 *** | 0.275 *** |
| GRC | 2.83 *** | 0.524 *** | -1.06 *** | -0.154 |
| HGK | 1.56 *** | 1.01 *** | -0.831 *** | 0.0197 *** |
| HUN | 0.713 *** | 0.793 *** | 1.6 *** | -1.63 * |
| IND | 0.81 *** | 0.878 *** | 0.446 *** | -0.0512 ** |
| IDN | 1.94 *** | 0.848 *** | -1.04 *** | 0.168 *** |
| IRL | 0.805 *** | 1.06 *** | -0.548 | 0.099 |
| ISR | 1 *** | 0.961 *** | 0.098 | -0.014 |
| ITA | 1 *** | 0.907 *** | 0.428 ** | -0.088 |
| JPN | 0.818 *** | 0.85 *** | 1.29 *** | -0.298 *** |
| MYS | 1.59 *** | 0.889 *** | -0.279 *** | 0.0284 ** |
| MEX | 2.97 *** | 0.764 *** | -2.4 *** | 0.48 *** |
| NLD | 0.936 *** | 0.943 *** | 0.242 | -0.223 |
| NZL | 1.09 *** | 0.901 *** | -0.442 *** | 0.119 |
| NOR | 1.48 *** | 0.726 *** | 2.27 *** | -0.403 *** |
| PER | 1.47 *** | 0.786 *** | -0.282 | -0.574 |
| PHL | 1.33 *** | 0.893 *** | 0.149 | -0.0903 * |
| POL | 0.965 *** | 0.822 *** | 0.137 *** | -0.002 |
| PRT | 0.598 *** | 0.905 *** | 1.16 *** | -0.458 |
| RUS | 1.69 *** | 0.634 *** | -0.211 | -0.080 |
| SGP | 1.73 *** | 0.893 *** | -1.16 *** | 0.264 *** |
| ZAF | 1.88 *** | 0.862 *** | -0.362 ** | 0.027 |
| KOR | 1.05 *** | 0.857 *** | 0.034 | -0.0398 ** |
| ESP | 2.47 *** | 0.812 *** | -2.29 *** | 1.04 *** |
| SWE | 2.68 *** | 0.815 *** | -1.44 *** | 0.169 *** |
| CHE | 2.52 *** | 0.908 *** | -3.69 *** | 1.67 *** |
| THA | 0.936 *** | 0.851 *** | 1.69 *** | -0.256 *** |
| TUR | 2.21 *** | 0.756 *** | -2.05 *** | 0.78 *** |
| GBR | 1.29 *** | 0.916 *** | -0.641 *** | 0.0252 *** |
| USA | 1.32 *** | 0.889 *** | -0.437 *** | 0.0646 *** |

Table 4: IRR vs. Estimated Investment Return

| | IRR | | | Estimated Investment Return | | |
|---|---|---|---|---|---|---|
| | Developed | Emerging | Diff | Developed | Emerging | Diff |
| 1997 | 0.093 | (0.063) | 0.156 | 0.074 | 0.052 | 0.022 |
| 1998 | 0.009 | (0.205) | 0.214 | 0.116 | (0.140) | 0.256 |
| 1999 | 0.076 | 0.174 | (0.098) | 0.052 | 0.223 | (0.170) |
| 2000 | 0.001 | (0.005) | 0.006 | 0.104 | (0.008) | 0.112 |
| 2001 | (0.020) | 0.032 | (0.052) | 0.030 | 0.019 | 0.011 |
| 2002 | (0.032) | 0.026 | (0.058) | 0.040 | 0.124 | (0.084) |
| 2003 | 0.198 | 0.171 | 0.028 | 0.061 | 0.282 | (0.220) |
| 2004 | 0.189 | 0.141 | 0.047 | 0.020 | 0.125 | (0.105) |
| 2005 | 0.106 | 0.148 | (0.042) | 0.026 | 0.090 | (0.064) |
| 2006 | 0.180 | 0.198 | (0.018) | 0.093 | (0.006) | 0.099 |
| 2007 | 0.083 | 0.222 | (0.139) | 0.016 | 0.103 | (0.087) |
| 2008 | (0.313) | (0.272) | (0.041) | (0.050) | (0.029) | (0.021) |
| 2009 | 0.133 | 0.235 | (0.102) | 0.063 | 0.213 | (0.150) |
| 2010 | 0.108 | 0.161 | (0.053) | 0.047 | 0.009 | 0.039 |
| 2011 | (0.062) | (0.085) | 0.023 | (0.001) | 0.005 | (0.006) |
| 2012 | 0.051 | 0.058 | (0.007) | 0.077 | 0.008 | 0.068 |
| 2013 | 0.153 | 0.013 | 0.141 | 0.028 | (0.007) | 0.035 |
| 2014 | 0.034 | 0.043 | (0.008) | 0.002 | 0.017 | (0.015) |
| 2015 | 0.071 | 0.035 | 0.037 | (0.007) | (0.085) | 0.077 |

Figure 3: ROA distribution by Country

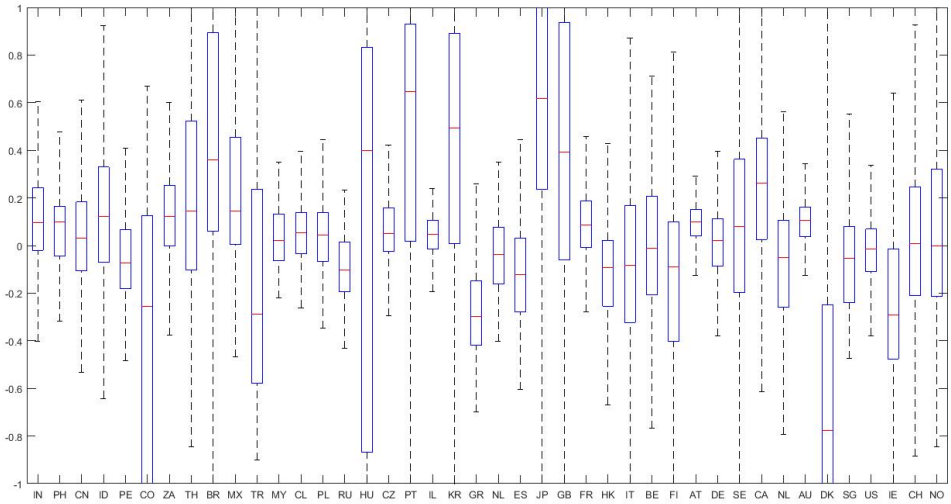

Table 5: Difference (Developed-Emerging Country Return) Comparison

| | ROA | IRR | Estimated | Hypothetical |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| 1997 | 0.021 | 0.156 | 0.022 | 0.027 |
| 1998 | 0.015 | 0.214 | 0.256 | (0.012) |
| 1999 | (0.039) | (0.098) | (0.170) | (0.128) |
| 2000 | (0.032) | 0.006 | 0.112 | (0.026) |
| 2001 | (0.063) | (0.052) | 0.011 | (0.142) |
| 2002 | (0.073) | (0.058) | (0.084) | (0.062) |
| 2003 | (0.054) | 0.028 | (0.220) | (0.145) |
| 2004 | (0.056) | 0.047 | (0.105) | (0.129) |
| 2005 | (0.053) | (0.042) | (0.064) | (0.053) |
| 2006 | (0.041) | (0.018) | 0.099 | (0.018) |
| 2007 | (0.037) | (0.139) | (0.087) | (0.056) |
| 2008 | (0.009) | (0.041) | (0.021) | 0.024 |
| 2009 | (0.054) | (0.102) | (0.150) | (0.166) |
| 2010 | (0.033) | (0.053) | 0.039 | (0.019) |
| 2011 | (0.008) | 0.023 | (0.006) | 0.021 |
| 2012 | (0.018) | (0.007) | 0.068 | (0.066) |
| 2013 | (0.001) | 0.141 | 0.035 | 0.049 |
| 2014 | (0.013) | (0.008) | (0.015) | (0.046) |
| 2015 | (0.011) | 0.037 | 0.077 | (0.002) |

Figure 4: ROA distribution by Country