Journal of Economics and Business xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Journal of Economics and Business

Stock returns and interest rates around the World: A panel data approach

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ARTICLE INFO

Article history:
Received 21 November 2015
Received in revised form 7 August 2016
Accepted 4 October 2016
Available online xxx

JEL classification:
G12
G15
F30

Keywords:
Dynamic panels
Emerging markets
Interest rates
Monetary policy
Stock returns

ABSTRACT

We examine quarterly stock returns of 21 developed and 19 developing economies from 1999 to 2013. Over this period, mean quarterly stock returns of 1.188% in developed economies contrast to 4.220% in developing economies. Economic growth has been substantially lower and interest rates have fallen (risen) in developed (developing) economies. Using dynamic panels, we find statistically significant negative effects of interest rates on stock returns in the developed countries, consistent with the expected cash flow hypothesis. In the developing markets, however, the world market portfolio is the sole determinant of stock returns. The contrasting effect of interest rates change on stock returns can be partially attributed to differing monetary policies and to the more mature capital markets inherent in developed economies.

1. Introduction

Central banks around the world adjust their policy rule (the benchmark interest rate) downwards when their economies weaken and upward when facing little inflationary pressures. Best understood as "Taylor rule" (1993), these adjustments become more important for some countries compared to others. It could also be that other (possibly external) factors are relevant in the central bank's decision rule. In any case, it is likely that financial markets of developed and developing economies react differently to monetary policy. Due to the need to attract foreign capital, developing market economies may be reluctant to cut rates that would decrease the attractiveness of their fixed-income financial assets in local currency. Developed countries, on the other hand, may face other problems with interest rates becoming extremely low, thus reducing the effectiveness of monetary policy (Swanson and Williams (2014)). Whether fluctuations of interest rates as a result of monetary policy have an effect on the stock market is thus a relevant research question. And it would be increasingly so after the recent global financial crises of 2008-2009 led to a decline in world economic growth and encouraged monetary policies

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http://dx.doi.org/10.1016/j.jeconbus.2016.10.001
0148-6195/

attempting to restore economic stability. In this paper, we contribute to the literature by providing empirical evidence about the uneven effects of monetary policy in developed and developing countries. Whereas strategic declines in benchmark interest rates in developed countries have contributed to a bull market, interest rates have not influenced stock market returns in developing countries as domestic monetary policy pursues different goals than those in developed countries. To our knowledge, comparable findings have not been documented as no other study has explored a similar research question.

Monetary policy, through interest rates, tends to affect the returns and therefore the prices of financial assets, thereby affecting economic decisions and economic growth. For instance, Bernanke and Reinhart (2004) state that current interest rates and the expectations for future low rates can positively influence asset prices as central banks engage in tacit agreements to maintain interest rates low, hence, strengthening the impact on financial assets.[1] However, extant research has uncovered mixed outcomes. Specifically, Sellin (2001) surveys the literature on monetary policy and stock prices prior to 2000 and concludes that there has been a positive impact of money supply on stock prices, yet this relationship is small and dependent on inflation rates. Kurihara (2006) finds that the decrease in interest rates during the Japanese quantitative easing period did not directly affect the stock market; however, exchange rates influenced stock prices. Moreover, Kimura and Small (2006) find that the Japanese quantitative easing (QE) increased the risk premiums for equities and low grade corporate bonds, hence, failing to increase stock prices. Conversely, Krishnamurthy and Vissing-Jorgensen (2011) find that the series of post-financial crisis QE events in the U.S. decreased the corporate risk premium, hence lowering the cost of capital. A great part of this outcome was based on investors' expectations of either lower yields or at a minimum the stability of existing low discount rates. Similarly, Aït-Sahalia, Andritzky, Jobst, Nowak and Tamirisa (2012) find that QE programs in developed economies (the U.S., the U.K., the Euro area, and Japan) indeed reduced the risk premium in the financial sector as financial institutions show lower risk of failure.

As described above, developed economies have persistently attempted to promote economic activity through a decrease in their domestic benchmark interest rates, particularly during the last decade. The documented shift in the discount rate is expected to be transmitted to the economy through capital markets, and more effectively, through the "wealth effect" of the stock market. Whereas the dynamics between interest rates and wealth creation are expected to have a similar outcome in developed and developing countries, only a limited amount of research analyze monetary policy and stock returns in the developing economies. We therefore contend that, particularly after a period of extraordinary emphasis on monetary policy, it is important to assess the link between stock returns and interest rates in both developing and developed countries, separately, due to their different monetary policies. For instance, Li (2011) mentions that in the developing countries, interest rates rise during economic downturns, due to increases in default risk. This countercyclical characteristic of interest rates (negative correlation with domestic output) contrasts with the behavior of interest rates in developed countries.

Extant literature examines the connection between stock returns and monetary policy, specifically, benchmark yields. Giovannini and Labadie (1991) find that the nominal interest rate predicts nominal stock returns extremely well using the sample of U.S. annual data spanning the period 1890–1987. Klyuev, De Imus and Srinivasan (2009) state that developed economies engaged in expansionary monetary policy to lower their benchmark interest rates, starting in the second half of 2007, and thereby influenced the prices of financial assets in an effort to boost the economy during the financial meltdown. Whereas some measures have been employed in the past, short-term interest rates already close to zero required some unconventional actions to affect the long-end of the curve, such as initiating quantitative easing programs, which includes the commitment to purchase mortgage backed securities (MBS) and corporate and treasury bonds. The effect of these novel policies affect stock and bond prices through different channels. Jansen and Tsai (2010) document an asymmetric impact of monetary policy during bull and bear U.S. markets between 1994 and 2005. Huang, Mollick and Nguyen (2016) report stronger linkages between U.S. S&P 500 stock returns and interest rates after January 2009 (when real interest rates became negative) using weekly data for VAR and copula methods to capture the structure of the dependence.

The study of asset pricing is at the core of financial economics and a fundamental finance principle asserts that the asset price equals the discounted future streams of cash flows. Two relevant factors come into play: the uncertainty of the expected cash flows and changes in the discount rate. Fundamental multi-factor models incorporate macroeconomic variables that affect the expected amount of discounted cash flows, which ultimately determines stock prices. For instance, James, Koreisha and Partch (1985) investigate the relation among stock returns, real activity, inflation, and money supply changes, finding that stock returns lead to shifts in inflation and nominal interest rates. The relationship between stock returns and macroeconomic factors has also been documented by Chen, Roll and Ross (1986), Burmeister and McElroy (1988), Lee (1992), Cheng (1996), Canova and De Nicoló (2000), among others.

Equilibrium asset pricing models, such as the capital asset pricing model (CAPM) (Lintner, 1965; Mossin, 1966; Sharpe, 1964), and the arbitrage pricing theory (APT) (Ross 1976) are based on expectations of discounted future cash flows. Hence, shifts in the discount rate and the expected streams of cash flows must consequently affect stock prices. Commonly, non-equilibrium models, such as multi-factor models, attempt to capture the variance of relevant pricing factors that could alter investors' expectations. Our empirical models, derived primarily from Chen et al. (1986) for the U.S., use explanatory variables such as a benchmark world stock index, real GDP growth, and discount rates, since these factors can influence the

[1] *The Wall Street Journal* reported on November 28, 2012 that the Fed's intention is "to chase investors out of super-safe U.S. Treasury and mortgages and into stock, corporate bonds and other assets riskier than Treasury." Also, on November 17, 2014 E.S. Browning's article in *The WSJ* on the coming interest rate hikes claims that "The longer the Fed waits, and the slower it goes once it starts raising rates, the happier stock and bond investors will be."

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perceived present value of the future stream of cash flows. In our case, however, we focus on two subsamples of countries to estimate how domestic stock returns respond to the influence of the world market portfolio and relevant macro-economic variables, such as nominal interest rate and RGDP.

Subsequent to financial integration for developing economies, we conjecture that the recent increase in stock returns has been primarily the result of expansionary monetary policy affecting the discount rate, and subsequently reflecting an increase in the fundamental value of equity markets. There are, of course, many forces that could affect the expected cash flow of earnings and any empirical model should take some of these into account. We find that decreases in the benchmark interest rate have positive effects on stock returns for developed markets but not for developing countries. In addition, the returns of equity markets for developed countries are positively influenced when their local currency depreciate against a basket of currencies possibly as a result of improving trade balances. This dynamic could be explained by the Mundell-Fleming effect of expansionary monetary policy with flexible exchange rates.[2] Our results remain robust after allowing for reverse causation of stock returns on the real GDP growth and to control for the global recessionary period.[3] Interestingly, we do not find support for the conjecture that investors get rewarded for stock market volatility, consistent with De Santis and Imrohoroglu (1997), who find that investors are not rewarded for country specific risk. Additionally, stock markets in developing and developed economies are strongly influenced by the world market index, consistent with previous evidence supporting a trend towards global market integration: Bekaert and Harvey (1995, 1997) and De Santis and Gerard (1997).

Expansionary monetary policy in developed economies has probably helped shape the recent bull market in equities. However, the experience of developing markets has been different as these countries have not engaged in reducing benchmark interest rates with similar intensity as developed economies. In developing markets, we find no significant relationship between stock returns and interest rates. Equity prices increase through a combination of both channels: an increase in the expectations of future streams of cash inflows and a decrease in the discount rate as in Jensen and Johnson (1995). We believe that monetary policy in developing countries has not influenced significantly either cash flows expectations or the discount rate.

We attempt to shed light on this research question of relevance for researchers and policy makers. To our knowledge, no prior study tests a comparable hypothesis during this period of relative financial integration, comparing the different policies pursued by developed and developing countries. We fill this gap in the literature by analyzing quarterly stock market returns and interest rate changes on a comprehensive dataset of 21 developed and 19 developing economies from 1999 to 2013.

This paper is organized in the following order: section two describes the samples, section three provides details on the econometric techniques, section four presents the results, and section five concludes this article.

2. The Samples

2.1. Data Description

Our main data source is *DataStream Thomson Reuters* (*DataStream* hereafter). We obtained the benchmark equity indices, short-term interest rates, and consumer price indices from *DataStream*. Our dependent variable (*stock returns*) equals the discrete quarterly growth rate of the domestic benchmark stock index. Chen et al. (1986) argue that the yield and default spread are more likely to affect stock prices rather than the interest rates directly. However, Abugri (2008) states that in foreign market research commonly use interest rates rather than spreads given the absence of active secondary markets for bond issues and government paper in some developed and most developing countries. Therefore, due to data availability across our sample of countries, we employ the short-term interest rates as measured by the 3-month benchmark yield. The corresponding equity indices and benchmark interest rates are listed in the Appendix A section (Tables A1 and A2).

Exchange rate fluctuations have an impact on expectations for economic output, for instance, through shifts in trade balances as, *ceteris paribus,* a strengthening currency makes domestic output more expensive to other countries. We therefore expect exchange rates to have an impact on domestic stock returns. To measure the strength of each country's currency, we employ the Real Effective Exchange Rate (*REER*) described in Darvas (2012). An increase in *REER* indicates a stronger country's currency against a basket of currencies. An increase in *REER* indicates a stronger country's currency against a basket of currencies[4].

Extant literature suggests the globalization period for the developing economies started in the early to mid-1990s: Levine and Zervos (1998), Henry (2000a, 2000b), Das and Mohapatra (2003), Bekaert and Harvey (2000) and Bekaert, Harvey and Lundblad (2005). Similarly, Edison and Warnock (2003) indicate that a reasonable cut-off point for the liberalization of most developing economies is 1995. However, since our database includes developed countries as well as developing, the launch of the Euro and the Asian crises in late 1990's may have created disruptions in the sample. Therefore, to circumvent these events, our sample period spans from the period of January 1999 to December 2013 at quarterly frequency. During this sample period

[2] We thank an anonymous referee for pointing out this important theoretical rationale.
[3] We proxy for the global recession dates using the U.S. recession dates as it is the most influential economy and this period coincides with the recessions in most countries in our sample. Following the NBER definition of the U.S. recession lasted from the fourth quarter of 2007 to the second quarter of 2009.
[4] See Darvas (2012) for details on the construction of this variable. This dataset is available at: http://www.bruegel.org/datasets/real-effective-exchange-rates-for-178-c

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most economies have experienced economic slowdowns and long recessions. We acknowledge the documented effect of the U.S. recessionary period on stock returns and include a dummy variable to capture the potential structural break in our tests. The dummy variable "*crises*" equals one during the last quarter of 2007 and until the second quarter of 2009, and zero otherwise. In our sample selection process we recognize that former socialist economies can have abnormal growth due to the switch in regime; therefore, they are excluded from the sample. Arabic stock exchanges are excluded due to their extreme dependence on oil prices and their lack of exposure to certain types of stocks due to religious guidelines, such as Sharia-compliant style investing. In addition, we require that the domestic stock exchange index (benchmark index) is available in *DataStream*. When the representative benchmark index is unavailable for the sample period in the benchmark section, we use the corresponding total stock market index commonly available in *Datastream*.

With these sample selection procedures, we are able to find stock market indices for 44 economies. However, an analysis of the data distribution at the country level indicates that Iceland has extreme values relative to the average values in the panel of developed countries and is therefore excluded from the sample. In addition, *Datastream* does not have available data on our variable of interest, short-term interest rates, for Bangladesh and Ghana. Pakistan is also excluded due to the absence of quarterly GDP data during our sample period. Our final sample includes 19 developing and 21 developed countries according to the classification provided by Lane and Milesi-Ferretti (2007). Yet, we further reclassify Singapore as developed country based on the criteria suggested by FTSE Global Equity Index, Russell Investments, and Dow Jones Indexes. Similarly, we categorize Greece as a developing economy following the classification from the Russell Index and the FTSE Global Equity Index.[5] The final sample of developed countries includes: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, New Zealand, Netherlands, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, United Kingdom, and the United States. The final sample of developing countries includes: Argentina, Brazil, Chile, China, Colombia, Ecuador, Greece, India, Indonesia, South Korea, Malaysia, Mexico, Peru, Philippines, South Africa, Sri Lanka, Thailand, Turkey, and Venezuela.

Whereas macroeconomic variables, such as interest rates, exchange rates, and GDP, capture some variance of stock returns, other relevant variables such as market microstructure can play a vital role. Since the microstructure features of domestic equity markets may not be fully captured by the set of macroeconomic variables selected, we also employ the volatility of stock returns as a control variable. While data on specific volatility measures of equity markets are readily available for developed equity markets, stock option volatility indexes are not commonly available in other stock markets. Mollick and Assefa (2013), for example, document under daily data from 1999 using GARCH models that stock returns in the U.S. respond negatively to increases in the VIX "fear gauge" index. In order to adopt a common approach to this issue, we estimate the volatility of monthly stock returns calculating the 24-month time-varying standard deviation (Sigma) similar to Petkova and Zhang (2005). We use the single index model relative to the world market portfolio to quantify stock market risk. Following De Santis and Gerard (1997), Chari and Henry (2002), and Abugri (2008), we proxy for the world market portfolio using the world index provided by *Morgan Stanley Capital International (MSCI)*.[6]

Differences related to economic growth rates, regulation and institutional frameworks, as well as structural differences in bond and equity markets provide compelling reasons to split the sample into developed and developing economies. In addition, the degree of financial integration (Bruner, Li, Kritzman, Myrgre, & Page, 2008; Harvey, 1995; Hunter, 2006), interest rates dynamics (Li, 2011), and equity risk (Esqueda, Assefa, & Mollick, 2012; Harvey, 1995) deem this segmentation necessary.

2.2. Stock Market Characteristics

Table 1 presents descriptive statistics for developed and developing countries in panels A and B, respectively. Panel A shows that, in developed countries, quarterly *stock returns* are 1.188% on average, with a minimum of negative 36.82 percent for Germany during the third quarter of 2002 and a maximum of 88.8 percent for Finland in the fourth quarter of 1999. The mean of *stock returns* for this panel is very close to the *MSCI* world index return (last row of the table), which has an average quarterly return of 1.00% over the study period with minimum of −22.2% in the fourth quarter of 2008 and a maximum of 19.7% for the second quarter of 2009. Also, the average *interest rate* is 2.67% for the group of developed countries. The minimum *interest rate* is 0% for Switzerland during the third quarter of 2011, until the last quarter of 2013. The maximum *interest rate* is for New Zealand with an 8.91 percent for the first quarter of 2008. The average *REER* is 97.9 for the developed countries with a minimum of 68.3 for New Zealand during the third quarter of the year 2000 and a maximum of 157.5 for the fourth quarter of 1999 for the Japanese Yen.

Since we commonly refer to stock returns rather than equity prices, we similarly measure the growth of the remaining series over the corresponding period. The average quarterly growth in the benchmark *interest rate* is −0.108%. The lowest rate of growth for *interest rates* is −87.78% for the U.S. during the fourth quarter of 2008. On the contrary, the highest growth rate for this variable is of 500 percent for Switzerland for the first quarter of the year 2000. On the *REER*, its average rate of

[5] FTSE Global Equity Index is reclassifying Greece as a developing economy starting on September 2015. We credit an anonymous referee for these suggestions.

[6] A value weighted world index, in USD, gross, and assumes dividend payout reinvestment. This index is available at: http://www.mscibarra.com/products/indices/international_equity_indices/performance.html

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Table 1
Descriptive Statistics.

Variables	N	Mean	Std. Dev.	Min	Max.
Panel A: Developed Countries					
Quarterly Return	1260	1.188	11.051	−36.817	88.780
(%)	1260	2.670	1.897	0	8.910
Interest Rate	1260	97.894	10.946	68.291	157.535
REER	1230	−0.108	27.739	−87.778	500.00
Δ Interest Rate	1240	0.111	2.628	−14.173	24.742
Δ REER	1231	0.499	1.308	−7.890	8.179
RGDP Growth	1260	0.054	0.021	0.015	0.146
Sigma					
Panel B: Developing Countries					
Quarterly Return	1140	4.220	16.381	−50.101	150.510
(%)	1105	8.114	6.915	0.001	58.180
Interest Rate	1140	99.274	20.245	45.049	264.238
REER	1087	1.872	45.494	−99.884	1025.00
Δ Interest Rate	1122	0.427	6.199	−60.527	70.640
Δ REER	1001	1.733	6.911	−28.279	33.707
RGDP Growth	1140	0.078	0.037	0.018	0.251
Sigma					
MSCI returns	1239	1.004	9.197	−22.176	19.725

Note: *Returns* are quarterly change in the stock indices. *MSCI returns* also quarterly changes in of MSCI world index. The change in interest rate, and *REER* are also the quarterly growth rates of respective variables. *RGDP Growth* is the quarterly growth of the real GDP. *Sigma* is the standard deviation of the stock returns using twenty four month rolling/time varying monthly indexes.

growth is 0.111 percent with a minimum of −14.173 percent for the United Kingdom during quarter four of the year 2008. The maximum *REER* growth rate equals 24.74 and corresponds to the fourth quarter of 2008 for the Japanese Yen, showing its appreciation during the financial crisis of 2008–2009. The average quarterly *real GDP* growth is 0.499 percent where Australia has the largest decline during the first quarter of 2009 with a negative 7.89 percent growth in real terms.

Singapore has the largest gain in *real GDP* (8.179%) among the developed countries during the first quarter of 2010. Stock market volatility (*Sigma*) measures the standard deviation of the domestic stock market. The average monthly standard deviation in the developed countries is 5.4%, with a minimum value of 1.5% for New Zealand for the second quarter of the year 2012 and a maximum of 14.5% for Finland for the third quarter of 2001.

Table 1 Panel B shows the descriptive statistics for the sample of developing countries. Panel B shows that this group of economies has on average *quarterly stock returns* of 4.22%. However, there is a large variation in returns during the first quarter of 2001: Ecuador shows a −50.10% quarterly return, while the Turkish stock market generated the largest returns with 150.5% gain during the last quarter of 1999. The average of annual *Interest Rates* for the group of developing countries is 8.11%. The highest rate corresponds to Venezuela, with a 58.18% interest rate for the first quarter of 2002, whereas the lowest *interest rate* is of 0.001 percent for the Philippines, corresponding to the fourth quarter of 2013.

In terms of changes, the average prevailing interest rate increase in developing countries during our sample period is on average 1.872%. This is the opposite of what was found in the developed countries, which had their benchmark interest rates coming down over time. One possible rationalization of this finding is that developing markets need to keep interest rates high or even increase interest rates in order to avoid capital flight or to perpetuate carry trade. There are extreme changes in benchmark interest rates, particularly in the Philippines, which has a decline of 99.89% during the fourth quarter of 2013, the largest for a developing country. Also the Philippines indicate the largest increase in *interest rates* with a 1,025 percent change in the sample, which occurred during the second quarter of the year 2013. The *REER* has an average change of 0.427% where the currency with the steepest change is the Argentinian Peso with a −60.527% change (largest currency depreciation against a basket of currencies) during the first quarter of the year 2002, prior to the Argentinian currency crises. Conversely, the highest increase in *REER* is 70.64% (largest currency appreciation) is for Venezuela during the second quarter of the year 2007.

Developing countries grew, in real terms, an average of 1.73 percent per quarter. However, there are substantial fluctuations in *RGDP growth* rates, particularly for China, as this country has the largest decline in *RGDP growth* (−28.27%) in the first quarter of 2013 and the largest increase in *RGDP growth* (33.70%) in the last quarter of 2007. Moreover, the average stock market volatility among developing economies equals 7.8 percent, with the minimum volatility experienced by Venezuela (1.8%) during the second quarter of 2011. Turkey, on the other hand, has the largest increase in stock market volatility with a 25.1% increase during the first quarter of 2001. Consistent with asset pricing models, stock markets from developing economies have compensated investors with higher equity returns (4.22% vs 1.19% quarterly) due to the higher risk (7.8% vs 5.4% average monthly standard deviation) observed in developing markets relative to developed markets. In addition, higher stock returns have a noticeable co-movement with real growth as developing economies grew faster than developed economies during our sample period. Lastly, developing markets have, on average, higher benchmark interest rates than developed countries. Whereas developed countries lowered their benchmark interest rates during sample period, developing countries increased their benchmark rates. Over the sample period, annual *interest rates* average 2.67 in developed

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countries and 8.11% in developing countries. In absolute terms, the *REER* among developing countries averages 99.3 compared to an average of 97.9 for developed countries during the same period. Under the Mundell-Fleming model, regardless of capital mobility, monetary policy is ineffective (effective) under a fixed exchange rate (under floating exchange rate).

Table 2 exhibits bivariate correlations coefficients among the set of regressors employed in the empirical models. Panels A and Panel B show the correlation matrix by country category of developed and developing countries, respectively. Table 2 Panel A indicates that the highest correlation in the developed countries is between the variables *MSCI returns* and *stock returns* (developed market), with a positive and significant correlation of 0.803.

Stock returns in developed economies are also positively correlated with *real GDP* growth (0.179), negatively correlated with interest rate (−0.172), and both are statistically significant. *Sigma* (monthly standard deviation of stock returns) exhibits a negative correlation (−0.227) with *interest rates*. Overall, the correlation among the control variables is moderate. For instance, *changes in interest rate* have a correlation of 0.165 with *real GDP* growth and 0.058 with *MSCI Returns*. Moreover, the change in interest rates is only slightly correlated (0.049) with the *change in REER*.

Table 2 Panel B indicates that developing market *stock returns* are positively correlated with *MSCI returns* (0.504) and statistically significant. Although *stock returns* appear positively correlated with *Sigma* (0.144) and the change in *REER* (0.127), the variable $\Delta REER$ has the opposite direction on correlations compared to the coefficients for this variable in the panel of developed markets. Contrasting with the correlation in the subsample of developed economies, *the change in interest rates* is negatively correlated with *stock returns* (−0.046) in the group of developing economies, although not statistically significant. Similarly, changes in *interest rates* are negatively correlated with changes in *REER* (−0.107). *Interest rates*, however, show no statistically significant correlation with *stock returns*, contrary to the relationship uncovered for developed countries. Overall, in Table 2 we find a substantially low degree of correlation among the regressors employed to explain *stock returns* in our models. We also observe that most of the variables move in a different fashion across the subsamples of developed and developing countries, thereby confirming contrasting features between both set of countries. In particular, in panel A (developed countries) *interest rates* move up with increases in *RGDP growth* (correlation coefficient of 0.165, with p-value of 0), consistent with Taylor rule mechanisms. This does not happen in panel B (developing countries) since the correlation coefficient between *changes in interest rates* and increases in *RGDP growth* is much lower (0.051, with p-value of 0.113).

3. Methodology

We test our hypothesis first using fixed effects models as this has been a popular model in the literature. Subsequently, we proceed with a dynamic panel approach, along the lines of Baltagi, Demetriades and Law (2009) and recent applications by Esqueda et al. (2012) and Assefa and Mollick (2014) for panels of stock markets. In dynamic panels, we are able to take into account the reverse causation from *stock returns* to *RGDP growth*. The rationalization for stock market *returns* and *real GDP* as endogenous variables goes as follows: On the one hand, *stock returns* are assumed to depend on *RGDP growth* given its information about the expected flow of earnings. This is what appears in the benchmark specification below. On the other hand, consumption is part of GDP in national income accounts: as C increases so does GDP. As wealth increases due to higher stock returns, there is an increase in the demand for money, which pushes up the equilibrium interest rates. This can be linked to Taylor-rule mechanisms as well, since central banks may react, shifting interest rates up (in booms) or down (in recessions).[7]

We initially examine our research questions using fixed effect models as follows:

$$StockReturns_{it} = \mu_i + \beta_1 \mathrm{RGDPGrowth}_{it} + \beta_2 \mathrm{MSCI}Returns_t + \beta_3 \Delta InterestRate_{it} + \beta_4 Crisis\,(dummy) + \beta_m X_{it}^m + \varepsilon_{it} \quad (1)$$

The dependent variable in (1) is represented by the *quarterly returns* on the benchmark index i during quarter t and μ_i represents country fixed effects. Our variables of interest are those that potentially affect cash flows (such as output growth with expected sign $\beta_1 > 0$), the state of world markets (*MSCI Returns*, $\beta_2 > 0$), and the stance of change in domestic *interest rates* during each period t for each country i (Δ *Interest Rates*, $\beta_3 < 0$). Some of these variables have been investigated by single country studies over the long-run.[8] The dummy variable accounts for possible structural breaks in the sample period, such as the U.S. recessionary period (*Crisis*, $\beta_4 < 0$) defined in the preceding section. We also control in some specifications for the competitiveness of home currency and stock volatility by the X_{it}^m vector of m control variables: changes in real effective exchange rate ($\Delta REER$), and monthly standard deviation of stock returns (*Sigma*). According to Chue and Cook (2008),

[7] Stock market *returns* and *RGDP growth* are the "gmm-style" variables in the xtabond2 STATA command based on Roodman (2009), with 2 and 3 lags used in sequence below. However, there is also the quarterly frequency used in this paper. If we do not limit the number of lags in the collapse procedure, there will be simply too many instruments. We adopt the following rule which is likely to mitigate the proliferation of instruments problem under quarterly frequency. We reduce the number of lags such that the final number of instruments used is less (or at least very close) to the number of cross-section units. We do this by imposing symmetric lag-limits on the whole number of quarters available. This method is used to address over identification of the model.

[8] A common academic reference for the equity premium (stock returns minus the risk free rate) is Welch and Goyal (2008), who find poor performance of both in-sample and out-of-sample models of stock returns. In the financial industry, for example, Davis et al. (2012) report R^2 of a regression model of 10-year ahead and 1-year ahead annualized U.S. stock returns on each of 15 regressors. Their "economic fundamentals" include trailing 10-year average U.S. RGDP growth, trailing 3-year average for "consensus" expected RGDP growth, yield of 10-year U.S. Treasury note, federal debt/GDP, and corporate profits/GDP. Stock returns were fitted over the Jan 1926-Jun 2012 period or over the Jan 1929-Jun 2012 period (for corporate profits) and the R^2's of all these economic fundamentals were close to zero. In particular, RGDP growth does not help forecast stock returns.

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Table 2
Correlation Matrix.

Variables	Quarterly Returns	RGDP Growth	Sigma	Interest Rate	REER	ΔREER	ΔInterest Rates	MSCI Returns
Panel A: Developed Countries								
Returns	1.000							
RGDP Growth	0.179	1.000						
	(0.000)							
Sigma	0.036	−0.040	1.000					
	(0.202)	(0.165)						
Interest Rates	−0.172	0.075	−0.227	1.000				
	(0.000)	(0.008)	(0.000)					
REER	−0.008	−0.065	−0.004	−0.344	1.000			
	(0.774)	(0.024)	(0.892)	(0.000)				
ΔREER	−0.039	0.024	−0.043	0.032	0.081	1.000		
	(0.172)	(0.405)	(0.132)	(0.264)	(0.004)			
ΔInterest rates	0.023	0.165	−0.101	0.075	0.037	0.049	1.000	
	(0.421)	(0.000)	(0.000)	(0.008)	0.197	(0.085)		
MSCI Returns	0.803	0.168	0.027	−0.230	0.063	0.094	0.058	1.000
	(0.000)	(0.000)	(0.343)	(0.000)	(0.028)	(0.001)	(0.041)	
Variables	Quarterly Returns	RGDP Growth	Sigma	Interest Rate	REER	ΔREER	ΔInterest Rates	MSCI Returns
Panel B: Developing Countries								
Returns	1.000							
RGDP Growth	0.005	1.000						
	(0.870)							
Sigma	0.144	0.026	1.000					
	(0.000)	(0.405)						
Interest Rates	0.041	−0.014	0.264	1.000				
	(0.178)	(0.665)	(0.000)					
REER	−0.024	−0.018	−0.066	0.002	1.000			
	(0.410)	(0.564)	(0.025)	(0.490)				
ΔREER	0.127	−0.003	0.045	−0.013	0.150	1.000		
	(0.000)	(0.916)	(0.136)	(0.673)	(0.000)			
ΔInterest rates	−0.045	0.051	−0.038	0.077	0.031	−0.107	1.000	
	(0.134)	(0.113)	(0.214)	(0.012)	(0.311)	(0.000)		
MSCI Returns	0.504	0.087	−0.036	−0.096	0.013	0.094	−0.021	1.000
	(0.000)	(0.006)	(0.227)	(0.002)	(0.667)	(0.002)	(0.489)	

*Significance level in parenthesis.

Table 3
Fixed Effect Models.

	(1) Developed Countries	(2)	(3)	(1) Developing countries	(2)	(3)
RGDP Growth	0.373**	0.378**	0.381**	−0.036	−0.039	−0.048
	(0.163)	(0.161)	(0.164)	(0.075)	(0.074)	(0.074)
MSCI returns	0.954***	0.968***	0.968***	0.855***	0.845***	0.861***
	(0.026)	(0.025)	(0.025)	(0.050)	(0.052)	(0.051)
ΔInterest Rate	−0.012**	−0.010**	−0.010**	−0.019**	−0.018**	−0.014**
	(0.005)	(0.005)	(0.005)	(0.008)	(0.008)	(0.007)
Crisis (dummy)	−0.810	−0.710	−0.707	0.001	−0.132	0.066
	(0.681)	(0.658)	(0.661)	(1.334)	(1.342)	(1.293)
ΔREER		−0.478***	−0.477***		0.178	0.157
		(0.082)	(0.082)		(0.122)	(0.118)
Sigma			0.008			0.634***
			(0.144)			(0.228)
NR-square within	12210.650	12210.663	12210.663	9700.279	9700.283	9700.298

The variable "Crisis" is a dummy variables for the crisis period (1 if 2007Q4–2009Q2 else 0). Standard errors in parentheses. * p < .10, ** p < .05, *** p < .01. Dependent variable: Stock returns.

the relationship between *stock returns* and *REER* in developing markets varies depending on the time period. Similarly, the evidence on stock returns and volatility is mixed. Nevertheless, currency and microstructure components may help complement the fundamental determinants of *stock returns* associated with the expected cash flow hypothesis. Finally, ε_{it} is an idiosyncratic error term.

In addition, to account for the potential endogeneity of *stock returns* and the state of the economy (*GDP growth*) we further employ the system GMM (SGMM) models proposed by Blundell and Bond (1998) to estimate dynamic panel versions of (1), with one lag of the dependent variable (subject to testing), as follows:

$$StockReturns_{it} = a + \beta_0 StockReturns_{it-1} + \beta_1 \mathrm{RGDPGrowth}_{it} + \beta_2 \mathrm{MSCI}Returns_t + \beta_3 \Delta InterestRate_{it} + \beta_4 Crisis\,(dummy) + \beta_m X_{it}^m + \varepsilon_{it} \quad (2)$$

As before, the dependent variable is country *i*'s *Stock Returns* and its lagged coefficient to be estimated by SGMM is $-1 < \beta_0 < 1$, and α is the intercept. Our variables of interest and the control variables are as indicated in (1) above and ε_{it} is the error term. In particular, the effect of domestic *interest rates* on the key benchmark stock index in each country is captured by the coefficient of *ΔInterest rate*, β_3. Of course, there are several ways to capture reverse causation from equity markets to regressors in (RHS) of (2). We report in this paper the treatment of wealth effects, although other channels may also be possible.[9]

4. Results and discussions

4.1. Fixed effects

We test the hypothesis that *interest rates* have influenced the increase in stock market values during our sample period. In our base model we control for *RGDP growth*, returns on the world index (*MSCI returns*), changes in interest rates (*ΔInterest rate*), changes in the real effective exchange rate (*ΔREER*), and stock market volatility (*Sigma*). Our regressors are described in detail in the Sample section. In addition, we include a *Crisis dummy* variable to capture the U.S. recessionary period, defined as 1 from 2007Q4 to 2009Q2 (and 0 otherwise), following the NBER definition of economic recessions.

Table 3 shows results of the fixed effects panel model. *RGDP growth* has a positive and significant effect on equity *returns* in developed countries (β_1-coefficient around 0.380) and virtually no influence in the group of developing countries. *Quarterly returns* from the world portfolio are priced in the domestic stock markets of both developed and developing economies as the coefficient of *MSCI returns* is strongly significant across both set of countries, as expected by asset pricing models. This coefficient represents the sensitiveness of the domestic stock returns to the returns of the world portfolio, comparable to Beta in the single index model. According to Harvey (1995), developing markets are less exposed to the returns of the world portfolio due to lower market integration; hence they have less systematic risk but higher country-specific risk. Correspondingly, we find that the magnitude of Beta is somewhat higher in developed (around 0.970) than in developing countries (around 0.850). This higher sensitiveness suggest that developed equity markets have a stronger linkage with the

[9] Another case of reverse causation is to allow stock returns to have an impact on the world market returns, which could be particularly important for large economies, such as U.S. or Europe, in which some local markets have admittedly a significant weight on world stock markets. While SGMM under these alternative assumptions of reverse causation have also been attempted by the authors, this approach is less intellectually appealing than the "wealth channel", which we report herein. It is also less relevant in practice since most countries in our sample do not have a large weight on world market returns.

Please cite this article in press as: Assefa, T. A., et al. Stock returns and interest rates around the World: A panel data approach. *Journal of Economics and Business* (2016), http://dx.doi.org/10.1016/j.jeconbus.2016.10.001

Table 4
System GMM Models.

	(1) Developed countries	(2)	(3)	(1) Developing countries	(2)	(3)
Return (lag1)	0.231**	0.175	0.170	−0.081	−0.088	−0.051
	(0.100)	(0.116)	(0.146)	(0.111)	(0.118)	(0.116)
RGDP Growth	−0.018	−0.072	−0.072	0.026	0.018	0.041
	(0.188)	(0.181)	(0.183)	(0.065)	(0.066)	(0.064)
MSCI returns	0.788***	0.942***	0.945***	1.093***	1.092***	1.013***
	(0.125)	(0.195)	(0.193)	(0.278)	(0.285)	(0.262)
ΔInterest Rate	−0.123**	−0.117**	−0.117**	−0.062	−0.061	−0.098
	(0.049)	(0.050)	(0.054)	(0.095)	(0.099)	(0.126)
Crisis(dummy)	−2.482	−1.124	−1.120	−1.129	−1.725	−7.513*
	(1.820)	(1.966)	(1.947)	(8.511)	(8.193)	(4.118)
ΔREER		−1.310	−1.313		0.259	0.250
		(0.803)	(0.806)		(0.581)	(0.584)
Sigma			−0.046			2.454
			(0.712)			(2.041)
m2	1.590	1.420	1.300	−0.670	−0.790	−0.810
	(0.113)	(0.156)	(0.193)	(0.500)	(0.432)	(0.419)
Hansen-J	13.240	7.670	7.580	15.480	14.570	14.140
	(0.584)	(0.906)	(0.870)	(0.279)	(0.266)	(0.226)
N	1221	1221	1221	970	970	970
No. of Instruments	21	21	21	19	19	19

The variable "Crisis" is a dummy variables for the crisis period (1 if 2007Q4–2009Q2 else 0). Standard errors in parentheses. * p<.10, ** p<.05, *** p<.01. Dependent variable: Stock returns. Two lags are assumed for stock returns and RGDP growth.

world index as previously suggested by Harvey (1995), Bekaert and Harvey (1997), among others. However, the difference is not statistically significant.

In Table 3, changes in interest rates (*ΔInterest rate*) have negative but small effects on *stock returns* in both developed and developing countries. This negative relationship is intuitive for the following reasons. The free cash flow valuation model estimates the fundamental value using the discount rate, that when increased, it reduces the present value of the expected cash flows, thereby decreasing stock prices. Conversely, a lower discount rate increases *stock returns*. As an additional channel, an expansionary monetary policy increases the money supply and thereby the wealth effect spills over to the stock market, and generates positive returns. That is similar to the findings of Patelis (1997) where contractionary monetary shocks predict lower stock returns. Yet, Patelis indicates it is not possible to fully attribute observed asset returns to monetary policy as other factors, such as dividend yields, are also important factors. Thorbecke (1997) report similar results that expansionary monetary policy leads to an increase in stock returns. Others, such as Fama and Schwert (1977) and Flannery and James (1984), document a negative effect of *interest rates* on *stock returns*, particularly due to the inflation component of interest rates.

The coefficient associated with the *Crisis* variable is negative but not statistically significant in the developed country panel. It also has mixed – and always not statistically significant values – in developing countries. The lack of a statistically significant coefficient for this regressor may be the result of endogeneity problems not accounted for. We address this issue in subsequent GMM models. Moreover, *REER* is negatively and significantly related with *stock return* in the developed countries sample only: currency appreciation leads to a decline in stock returns, possibly due to the negative effect on trade balance following the fall in net exports. This is consistent with Mundell-Fleming model's effective monetary policy under a floating exchange rate regime. But no such relationship is found for the developing country sample, which is presumably more dependent on trade effects to grow. This suggests that the link between trade and equity markets looks not only weak but also against the notion that developing economies are more dependent on trade than the developed world. The effect of *Sigma* is positive and statistically significant in developing countries, consistent with the principle of earning higher returns for holding riskier assets. Yet, *Sigma* has no significant effect on the *stock returns* of developed countries, as we observed in the correlation matrix, possibly due to the higher exposure to the world portfolio (systematic risk). As seen in the R^2 statistics, 66.0% of the variance of stock returns in developed countries (a little less than 30% for developing countries) is explained by the set of macro variables and other controls.

4.2. System Generalized Method of Moments (SGMM)

In Table 4, we examine the effect of benchmark *interest rates* on domestic *stock returns* as shown in Eq. (2) above. We employ SGMM as there is potential reverse causality between *RGDP growth* and the dependent variable, *stock returns*. For instance, Choi, Hauser and Kopecky (1999) examine whether lagged stock returns predict industrial production. In this model specification, *RGDP growth* is not significant across both samples of developed and developing economies, which may be due to the instruments employed to control for endogeneity (which we test in Table 6). In addition, the endogeneity could be the reason for the high coefficient value in Table 3; but when we account for reverse causality, no statistically significant effect remains. Given the strong correlation of *RGDP growth* and the *returns* on the world index, the variable *MSCI returns*

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Table 5
System GMM Models.

	(1) Developed countries	(2)	(3)	(1) Developing countries	(2)	(3)
Return (lag1)	0.169**	0.082	0.084	−0.160	−0.158	−0.149
	(0.080)	(0.122)	(0.121)	(0.246)	(0.244)	(0.261)
RGDP Growth	0.044	−0.074	−0.069	−0.018	−0.019	−0.023
	(0.179)	(0.204)	(0.215)	(0.071)	(0.071)	(0.075)
MSCI returns	0.825***	1.063***	1.055***	1.179***	1.179***	1.153***
	(0.088)	(0.148)	(0.166)	(0.196)	(0.197)	(0.238)
ΔInterest Rate	−0.106***	−0.092**	−0.094**	−0.003	−0.003	0.001
	(0.039)	(0.041)	(0.042)	(0.096)	(0.095)	(0.096)
Crisis(dummy)	−2.827*	−1.378	−1.365	1.038	0.914	2.126
	(1.651)	(2.229)	(2.199)	(5.843)	(5.848)	(4.325)
ΔREER		−1.640	−1.594		0.051	0.055
		(1.053)	(1.115)		(0.431)	(0.441)
Sigma			−0.085			−0.878
			(0.537)			(2.729)
m2	1.460	1.100	1.140	−0.480	−0.490	−0.460
	(0.145)	(0.269)	(0.225)	(0.631)	(0.642)	(0.646)
Hansen-J	15.470	8.110	7.980	16.140	15.790	16.150
	(0.418)	(0.884)	(0.845)	(0.241)	(0.201)	(0.136)
N	1221	1221	1221	970	970	970
No. of Instruments	21	21	21	19	19	19

The variable "Crisis" is a dummy variables for the crisis period (1 if 2007Q4–2009Q2 else 0). Standard errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Dependent variable: Stock returns. Three lags are assumed for stock returns and RGDP growth.

Table 6
System GMM Models.

	(1) Developed countries	(2)	(3)	(1) Developing countries	(2)	(3)
RGDP Growth (lag1)	−0.053	−0.041	−0.048	−0.608***	−0.608***	−0.609***
	(0.106)	(0.098)	(0.060)	(0.112)	(0.114)	(0.124)
Stock Return	0.076***	0.067***	0.061***	0.319*	0.354**	0.323*
	(0.016)	(0.015)	(0.020)	(0.169)	(0.177)	(0.181)
ΔInterest Rate	0.012*	0.013	0.013	−0.025	−0.022	−0.033
	(0.007)	(0.008)	(0.008)	(0.092)	(0.095)	(0.103)
Crisis(dummy)		−0.342	−0.457		4.001	2.347
		(0.574)	(0.360)		(2.935)	(4.531)
ΔREER			0.085			0.590
			(0.268)			(0.538)
m2	−0.770	−0.810	−0.930	−1.530	−1.570	−1.560
	(0.440)	(0.416)	(0.350)	(0.126)	(0.115)	(0.119)
Hansen-J	20.070	19.480	20.170	12.730	10.580	12.040
	(0.271)	(0.244)	(0.165)	(0.623)	(0.719)	(0.524)
N	1200	1200	1200	953	953	953
No. of Instruments	21	21	21	19	19	19

The variable "Crisis" is a dummy variables for the crisis period (1 if 2007Q4–2009Q2 else 0). Standard errors in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01. Dependent variable: RGDP growth.

has captured most of the explanatory power of *RGDP growth* with *stock returns*. Moreover, the coefficient for *ΔInterest Rates* becomes larger and significant (in the developed countries) when *RGDP growth* is considered endogenous.

In the dynamic panel SGMM presented in Tables 4 and 5 we limit the number of lags in the collapse command such that the final number of instruments is slightly below the number of cross-section units as discussed in the preceding Methodology section. This method is developed by Roodman (2009) to reduce over-identifying the model due to proliferation of instruments. Table 4 reports the results of SGMM limiting the number of lags (quarters) taken in the *collapse* command. This model specification provides more robust coefficients as long as the number of instruments is reduced to 21 and 19 for the developed and developing countries, respectively. In all reported cases, specification tests are found to be satisfactory, either by serial correlation tests or by Hansen-J's tests of validity of instruments.

Table 4 shows *RGDP growth* losing its statistical significance, compared to the fixed effect models, and *MSCI returns* remaining virtually with the same coefficients (close to 1) and highly statistically significant. The lag of the dependent variable, *stock returns*, is positive (negative) in all models for the sample of developed (developing) countries, although it is only statistically significant in one model for developed countries. The opposite sign across the developing sample further supports our premise on sample characteristics. Since previous research suggests that stock returns lead economic growth, it seems reasonable that *RGDP growth* has a lower contribution in the GMM models in Table 4 compared to the fixed effects models in Table 3. The coefficients on *ΔInterest rates* in developed economies vary from −0.123 in column (1) to −0.117

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in columns (2) and (3) of Table 4. These suggest a quite significant effect of Δ*interest rate* on *stock returns* for developed countries: in response to a 10% increase in *interest rates*, *stock returns* fall by 1%, all else constant. Our finding between *stock returns* and *interest rates* for the developed market is robust to the changes of lag length in endogenous variables (*stock returns* and *RGDP*) from 2 to 3 lags (Table 5) and also to the exclusion of *RGDP growth* from the model (Table A3 in the Appendix A).[10] Findings on monetary policy and stock returns have been reported for the U.S. by Fama and Schwert (1977), Flannery and James (1984), Patelis (1997), and Thorbecke (1997). Our results extend this body of literature to panels of countries in a more recent period (1999–2013), including the recent 2008–2009 financial crisis.

The *crisis* variable remains negative, although it is significant only in model 3 of the developing countries sample. In addition, the coefficient for Δ*REER* lost its significance in developed economies compared to the fixed effect model results shown in Table 3. Another major difference is that the coefficient for *Sigma* becomes not significant in the current set of regressions, for both developing and developed countries. Furthermore, in developing markets it is possible that the risk has been accounted for through the remaining regressors in the models and thereby reducing the impact of *Sigma*.

More importantly, the results for our hypothesis on the relationship between benchmark *interest rates* and *stock returns* remain unchanged from Table 3 (fixed effect models) for developed countries. However, in the sample of developing countries the corresponding coefficients lost their significance. We find that, in developing countries, *stock returns* are not sensitive to *interest rate* changes according to the discounted cash flow hypothesis put forward by Chen et al. (1986). The only statistically significant variable is the *MSCI returns* and in an approximate one to one relationship.

Due to the more volatile nature of flows to developing countries, what really matters for equity investors in these markets is the state of the global equity markets. In other words, domestic benchmark *interest rates* become relatively less important for *stock returns* in the developing world as their equity markets do not seem to respond to domestic monetary policy.[11] One possible explanation for this finding is that the mature financial markets inherent in developed economies simplify firms' access to capital markets and hence lowers the cost of capital, therefore increasing share prices. However, this is not the case in developing markets, which have less mature stock and bond markets.[12]

As a robustness check, we specify our models with three lags as instruments and the results are presented in Table 5. We observe that most of the coefficients remain unchanged. However, the coefficient for the *Crisis* variable is not statistically significant in the models for the subsample of developing countries. Yet, it becomes statistically significant in one model corresponding to the developed countries. This is consistent with the definition of the variable as this dummy variable captures the recessionary period of the U.S., which was shared by other developed nations, but not necessarily by most developing countries. The remaining results of Table 4 are robust to this new model specification and we observe no major changes in the coefficients.[13]

Lastly, to test the reverse causation of *stock returns* and *RGDP growth*, we regress *RGDP growth* as a function of *stock returns*, *interest rates*, a *crisis dummy* variable, and *the change in REER*. The results are shown in Table 6.[14] Clearly, *stock returns* appear to be a good predictor of *RGDP growth* in both panels, with the effect appearing statistically stronger in developed countries ($p < .01$ in developed vs $p < .10$ in developing countries). These findings are consistent with the leading indicator role of equities as reported in the business cycle literature.

Table 7 presents the summary of Fixed Effect Model (FEM) and System GMM (SGMM) models indicating the statistically significant variables. The FEM indicates that more variables are significant in both developed and developing countries compared to the SGMM model. The difference could be attributed to the treatment of the endogenous variable, namely *Real GDP growth*, in the dynamic panel.

5. Concluding Remarks

We examine *stock returns* as a function of expected cash flows and discount rates using 21 developed countries and 19 developing countries in a panel data setup at quarterly frequency from January 1999 to December 2013. We test our hypothesis first using fixed effects models as this has been a popular model in the literature. Subsequently, we proceed with a dynamic panel approach, which can be implemented in a variety of ways depending on how reverse causation is modeled. We here report SGMM results when allowing for stock returns to have an impact on the goods and services market (*RGDP growth*), the so-called "wealth channel".

[10] For the robustness tests, in Table A3, we exclude Real GDP as it shows no statistical significance in previous models (Table 4 and 5) for any of the samples.

[11] As a robustness check, we run the models on the subsample of developing countries excluding Brazil, China, and India. The overall results remain. Yet, in model 2 REER become significant and in Model 3 Sigma – stock return volatility become statistically significant at a 10% level. In model three, Sigma –stock return volatility becomes positive and statistically significant at a 1% significance level. We thank the associate editor for this suggestion

[12] We thank an anonymous referee for suggesting this explanation on the relationship between interest rates and stock returns.

[13] As an additional robustness check, we exclude RGDP growth given the lack of significance in previous models. REER become significant in the new models but the main findings remain unchanged. These results are reported in Table A3 in the Appendix A. In addition, we also run the model including RGDP growth and the change in interest rate as endogenous variables. Yet, the model does not show statistically significant coefficients for interest rates in any of the subsamples. The results are not reported but are available upon request.

[14] We thank the editor for this suggestion that strengthened the presumption of reverse causation. We employ a similar way of addressing reverse causation as Choi et al. (1999) although they use a VECM.

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Table 7
Result Summary Table of Significant Variables.

Fixed Effect Models		
	Developed countries	Developing countries
RGDP Growth	*Positive & Sig.*	
MSCI returns	*Positive & Sig.*	*Positive & Sig.*
ΔInterest Rate	*Negative & Sig.*	*Negative & Sig.*
Crisis(dummy)		
ΔREER	*Negative & Sig.*	
Sigma		*Positive & Sig.*
System GMM Models		
RGDP Growth		
MSCI returns	*Positive & Sig.*	*Positive & Sig.*
ΔInterest Rate	*Negative & Sig.*	
Crisis(dummy)		
ΔREER Sigma		

Dependent Variable: Stock returns.

The fixed effects models identify very small interest rate effects on *stock returns*, varying from −0.010 to −0.012 in developed countries and from −0.014 to −0.019 in developing countries. While negative as expected, the estimated value of the *change in interest rate* coefficients look surprisingly similar across panels in the fixed effects models. We confirm the presumption of reverse causality by regressing *RGDP growth* as a function of *stock returns* and control variables. To address the reverse causality between *stock returns* and *RGDP growth* found in our sample and documented in the literature, we employ SGMM models. Our results indicate that *RGDP growth* and *MSCI returns* remain virtually with the same coefficients as in the fixed-effects models.

However, the coefficients on *ΔInterest rates* become much larger in developed economies and lose statistical significance in developing economies. These results suggest a quite significant effect of benchmark yields on *stock returns* in the developed countries. In response to a 10% increase in interest rates, relative to the previous quarter, *stock returns* fall by 1%, all else constant. Our most likely interpretation is that the declines in interest rates over time reflect the disinflation period and the attempts by central banks of developed economies to fight the severe recession of 2008–2009. Lower interest rates support consumer spending and corporate profits. And, across the term structure of interest rates, lead to lower bond yields as well.

Our findings between *stock returns* and *interest rates* for the developed market are very robust to changes of lag length in endogenous variables (*stock returns* and *RGDP*), as well as to exclusion of *real GDP growth* from the model. Long-run analysis for U.S. stock returns by Davis, Aliaga-Diaz and Thomas (2012), along the lines of Welch and Goyal (2008), have suggested that *RGDP growth* does not help forecast *stock returns*. Our results are consistent with these findings. Whereas we do not find direct effects of *RDGP growth* on equity markets, there is evidence of an indirect effect through benchmark *interest rates* in developed economies, which have all conducted recent expansionary policies to deal with the financial crisis of 2008-2009. The results in this paper also suggest that macro determinants are not "priced in" *stock returns* of developing countries. Since these developing markets appear to be sensitive only to the state of world markets, a topic for future research is how these markets respond to forces affecting the world economy, such as commodity prices and the degree of risk aversion, or the stance of monetary policy in developed economies.

Appendix A.

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Table A1
List of indices by country with *Datastream* index name and code.

Developing Countries			Developed Countries		
Country	Index	Code	Country	Index	Code
Argentina	ARGENTINA MERVAL – PRICE INDEX	ARGMERV	Australia	ASX ALL ORDINARIES 1971>– PRICE INDEX	AUSTOLD
Brazil	BRAZIL BOVESPA – PRICE INDEX	BRBOVES	Austria	ATX – AUSTRIAN TRADED INDEX – PRICE INDEX	ATXINDX
Chile	CHILE SELECTIVE (IPSA) – PRICE INDEX	IPSASEL	Belgium	BEL 20 – PRICE INDEX	BGBEL20
China	SHANGHAI SE COMPOSITE – PRICE INDEX	CHSCOMP	Canada	S&P/TSX COMPOSITE INDEX – PRICE INDEX	TTOCOMP
Colombia	COLOMBIA-DS Market – PRICE INDEX	TOTMKCB	Denmark	OMX COPENHAGEN (OMXC20) – PRICE INDEX	DKKFXIN
Ecuador	S&P ECUADOR BMI – PRICE INDEX	IFFMECL	United Kingdom	FTSE 100 – PRICE INDEX	FTSE100
Greece	GREECE-DS Market – PRICE INDEX	TOTMKGR(PI)	Finland	OMX HELSINKI (OMXH) – PRICE INDEX	HEXINDX(PI)
India	INDIA BSE (SENSEX) 30 SENSITIVE – PRICE INDEX	IBOMSEN	France	FRANCE CAC 40 DS-CALC. – PRICE INDEX	FRCAC4Z(PI)
Indonesia	INDONESIA-DS DS-MARKET EX TMT – PRICE INDEX	TOTXTID	Germany	DAX 30 PERFORMANCE – PRICE INDEX	DAXINDX(PI)
Korea	KOREA SE COMPOSITE (KOSPI) – PRICE INDEX	KORCOMP	Ireland	IRELAND SE OVERALL (ISEQ) – PRICE INDEX	ISEQUIT(PI)
Malaysia	FTSE BURSA MALAYSIA KLCI – PRICE INDEX	FBMKLCI	Italy	ITALY-DS Market – PRICE INDEX	TOTMKIT
Mexico	MEXICO IPC (BOLSA) – PRICE INDEX	MXIPC35	Japan	NIKKEI 225 STOCK AVERAGE – PRICE INDEX	JAPDOWA
Peru	LIMA SE SELECTIVE(ISBL) – PRICE INDEX	PESELEC	Netherlands	AEX INDEX (AEX) – PRICE INDEX	AMSTEOE
Philippines	PHILIPPINE SE (PSEI) – PRICE INDEX	PSECOMP	New Zealand	NEW ZEALAN-DS Market – PRICE INDEX	TOTMKNZ
South Africa	FTSE/JSE ALL SHARE – PRICE INDEX	JSEOVER	Norway	OSLO SE OBX – PRICE INDEX	OSLOOBX
Sri Lanka	SRI LANKA-DS Market – PRICE INDEX	TOTMKCY	Portugal	PORTUGAL PSI-20 – PRICE INDEX	POPSI20
Thailand	THAILAND-DS Market – PRICE INDEX	TOTMKTH	Singapore	SINGAPORE-DS DS-MARKET EX TMT – PRICE INDEX	TOTXTSG
Turkey	ISE NATIONAL 100 – PRICE INDEX	TRKISTB	Spain	MADRID SE GENERAL – PRICE INDEX	MADRIDI
Venezuela	VENEZUELA-DS Market – PRICE INDEX	TOTMKVE	Swedan	OMX STOCKHOLM 30 (OMXS30) – PRICE INDEX	SWEDOMX
			Switzerland	SWISS MARKET – PRICE INDEX	SWISSMI
			United States	S&P 500 COMPOSITE – PRICE INDEX	S&PCOMP

Note: The second and fifth columns are the index names as shown in *Datastream* Thomson Reuters. The third and sixth columns are the *Code* for a given index. When a benchmark index for a given country was not available in *Datastream*, we selected the "DS market index" for the corresponding stock market.

Table A2
Description of the interest rates used by country with series name and code.

	Developing Countries		Developed Countries		
Country	Name	Code	Country	Name	Code
Argentina	Argentina Deposit 90 Day (pa.) – Middle Rate	AG90DPP	Australia	Australian $ Depo 3 Mth (icap/tr) – Middle Rate	GSAUD3M
Brazil	Brazil CDB (up To 30 Days) – Middle Rate	BRCDBIR	Austria	Austria Vibor 3 Month – Offered Rate	ASVIB3M
Chile	Chile CD 90 Day – Middle Rate	CLCD90D	Belgium	Belgium Interbank 3 Month – Offered Rate	BIBOR3M
China	China Relending Rate, 3 m – Middle Rate	CHDIS3M	Canada	Canada Prime 90 Day Corporate Paper – Middle Rate	CN13858
Colombia	Colombia Fixed Term Deposit – Middle Rate	CBFTDEP	Denmark	Denmark Interbank 3 Month – Offered Rate	CIBOR3M
Ecuador	Ecuador Interbank Weightd Avg. Rte – Middle Rate	EDIBMWA	United Kingdom	UK Interbank 3 Month – Middle Rate	LDNIB3M
Greece	Greece Interbank 3 Month – Middle Rate	GDIBK3M	Finland	Finland Interbank Close 3 Month – Middle Rate	FNIBC3M
India	Mumbai Interbank Three Month – Middle Rate	INIBK3M	France	France Interbank 3 Month – Offered Rate	PIBOR3M
Indonesia	Indonesia Deposit 3 Month 'dead' – Middle Rate	IDDEP3M	Germany	Germany Interbank 3 Month – Offered Rate	FIBOR3M
Korea	Korea Commercial Paper 91d – Middle Rate	KOCP91D	Ireland	IR Interbank Offered Rate – 3 Month (EP)	IRINTER3
Malaysia	Malaysia Interbank 3 Month – Middle Rate	MYIBK3M	Italy	Italy Interbank 3 Month – Offered Rate	ITIBK3M
Mexico	Mexico Cetes 91 Day Closing – Middle Rate	MXCTC91	Japan	Tokyo Interbank JP Yen 3 m – Offered Rate	JPIBK3M
Peru	Peru Loan Rate – Middle Rate	PSTIPMN	Netherlands	Netherland Interbank 3 Month – Offered Rate	AIBOR3M
Philippines	Philippine Treasury Bill 91d – Middle Rate	PHTBL3M	New Zealand	New Zealand 90 Day Bankbill – Middle Rate	NZBB90D
South Africa	SA Bankers' Acceptances – 3 m – Middle Rate	SABKR3M	Norway	Norway Interbank 3 Month – Offered Rate	NWIBK3M
Sri Lanka Treasury Bill 3 Month – Middle Rate	Sri Lanka	SRTBL3M	Portugal	PT Lisbon Interbank Offer Rate – 3 Month (EP)	PTINTER3
Thailand	Thailand Interbank 3 Mth (bb) – Offered Rate	THBBIB3	Singapore	Singapore Interbank 3 Month – Middle Rate	SNGIB3M
Turkey	Turkish Interbank 3 Month – Offered Rate	TKIBK3M	Spain	Spain Interbank 3 Month – Middle Rate	ESMIB3M
Venezuela	Venezuela 90 Day Deposit Rate – Middle Rate	VEDP90D	Sweden	Sweden Interbank 3 Month – Middle Rate	SIBOR3M
			Switzerland	Swiss Interbank 3 M (ZRC:SNB) – Bid Rate	SWPRATE
			United States	US Treasury Bill 2nd Market 3 Month – Middle Rate	FRTBS3M

Note: The second and fifth columns are the description of the interest rates series used, as shown in *Datastream* Thomson Reuters or the IFS. The third and sixth columns are the *Code* for a given series of interest rates.

Please cite this article in press as: Assefa, T. A., et al. Stock returns and interest rates around the World: A panel data approach. *Journal of Economics and Business* (2016), http://dx.doi.org/10.1016/j.jeconbus.2016.10.001

Table A3
System GMM Models.

	(1) Developed countries	(2)	(3)	(1) Developing countries	(2)	(3)
Return (lag1)	0.232**	0.178	0.174	−0.057	−0.056	−0.049
	(0.098)	(0.111)	(0.139)	(0.118)	(0.125)	(0.125)
MSCI returns	0.786***	0.934***	0.936***	1.030***	1.024***	0.974***
	(0.123)	(0.187)	(0.184)	(0.256)	(0.265)	(0.252)
ΔInterest Rate	−0.123**	−0.118**	−0.118**	−0.037	−0.042	−0.072
	(0.048)	(0.049)	(0.053)	(0.069)	(0.072)	(0.092)
Crisis(dummy)	−2.467	−1.086	−1.082	−0.742	−1.550	−6.496*
	(1.794)	(1.942)	(1.924)	(8.147)	(7.652)	(3.875)
ΔREER		−1.288*	−1.291*		0.348	0.332
		(0.747)	(0.748)		(0.643)	(0.635)
Sigma			−0.044			2.181
			(0.706)			(2.010)
m2	1.610	1.460	1.340	−0.740	−0.890	−0.950
	(0.107)	(0.144)	(0.179)	(0.459)	(0.374)	(0.344)
Hansen-J	13.570	7.810	7.700	17.290	16.960	16.300
	(0.631)	(0.931)	(0.905)	(0.241)	(0.201)	(0.178)
N	1229	1229	1229	1086	1086	1086
No. of Instruments	21	21	21	19	19	19

The variable "Crisis" is a dummy variables for the crisis period (1 if 2007Q4–2009Q2 else 0). Standard errors in parentheses * p < 0.10, ** p < 0.05, *** p < 0.01. Dependent variable: Stock returns.

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