Foreign Capital in a Growth Model[*]

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ABSTRACT

Within an endogenous growth framework, this paper empirically investigates the impact of financial capital on economic growth for a panel of 60 developing countries, through the channel of domestic capital formation. By estimating the model for different income groups, it is found that while private FDI flows exert beneficial complementarity effects on the domestic capital formation across all income-group countries, the official financial flows contribute to increasing investment in the middle income economies, but not in the low income countries. The latter appears to demonstrate that the aid-growth nexus is supported in the middle income countries, whereas the misallocation of official inflows is more likely to exist in the low income countries, suggesting that aid effectiveness remains conditional on the domestic policy environment.

JEL Classification: F43, O11

Key Words: Endogenous growth, Developing countries, FDI (foreign direct investment), ODA (official development assistance), GMM

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1. Introduction

The longstanding debate over the relationship between foreign capital inflows and economic development continues to remain an unresolved issue.[1] A growing concern with the impact of the official lending programmes in developing economies[2] and the catalytic effect that official lending is likely to help private flows raise a theoretical question as to how best to treat the role of foreign capital in long run economic growth. In the neoclassical growth context, the benefits of a once-for-all foreign capital inflow (even in the form of a gift) to the host country are of a temporary nature (see Crouch, 1973), as the standard model of economic growth has been mostly supply-driven within the framework of neo-classical theory in which the process of capital accumulation is driven by household savings behaviour and there is absence of aggregate demand effects that are more likely to be influenced by foreign capital. Further, the core part of the analytical framework of the financing gap models of the World Bank for funding structural adjustment[3] advocates that higher investment is necessary for long-run growth. Also when there is a general collapse in domestic demand, the role of the government in supporting demand at such a time of crisis becomes important. Thus investment demand, both private and government spending, is a crucial determinant of growth suggesting that it is the rate of growth of demand that may constrain the rate of output growth. Such investment may be influenced by external financial flows, which should be considered while modelling economic growth.

These different views motivate us to reinvestigate factors determining economic growth, in particular whether growth can be described by incorporating both real capital (physical and human) and financial capital including external flows. As many low income countries continue to grow below their potential, owing to either lack of new capital or inefficient use of existing capital, a better economic performance hinges crucially on higher productive investment, which can help increase productive capacity in the long run. That can come about if governments free up funds for badly needed investment in infrastructure and social development, curtailing government's huge consumption expenditure[4] (Mallick, 2001). But lower levels of investment expenditure could lead to a shortage of physical capital and thereby retard economic growth. In

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[1] See White (1992), Collier and Dollar (2004), and Addison et al. (2005) for a comprehensive survey of issues relating to development finance. Fosu et al. (2004) provide an overview on the role of all forms of capital – physical, human and financial – in the growth and development of African economies, within the context of the global economy.

[2] For a recent analysis on the effects of IMF and World Bank lending, see Butkiewicz and Yanikkaya (2005), and Granville and Mallick (2005).

[3] For an overview of the gap models, see Bacha (1990), and Taylor (1994).

[4] Besides, Ghatak and Ghatak (1996) find significant crowding-out effects of government consumption on private consumption.

the 1990s, capital flows were mainly in the form of foreign direct investment (FDI) and portfolio investment, including bond and equity flows. This paper therefore attempts to investigate the impact of different types of foreign capital (both official and private capital flows), which help finance investment and stimulate economic growth in the developing world, within an endogenous growth model driven by aggregate investment demand, using panel data for 60 developing countries during 1970-2003.

This paper differs from existing studies in the following aspects. First, the empirical model is theoretically based on the mechanism of endogenous growth augmented by a demand led investment model. In general, the foreign aid and growth links are specified in an ad-hoc manner, see for example Burnside and Dollar (2000), Collier and Dollar (2001), and Hansen and Tarp (2001). One of the shortcomings of this line of empirical literature is that they give up the time dimension of the data and thus could fail to uncover the true relationship (see Jones, 1995). Another strand of empirical literature for the relationship between private financial flows and economic growth also focuses on modelling the relation in an ad-hoc manner, where the model is typically augmented with other hypothetical or intuitive variables. Among others, the panel VAR approach by Choe (2003) and cointegration analysis by DeMello (1999) present different methodology, yet without a theoretical structure. Exceptions are such as that of Otto and Voss (2003), who investigated the effect of public investment on economic growth based on the Solow type model, and Mallick and Moore (2005), who examined the impact of World Bank lending on growth within an adjustment-led growth model.

Second, this paper investigates the channels of financial inflows on growth via investment. Much of the empirical studies tend to focus on either growth versus financial inflows or growth versus investment, and find a positive effect of capital inflows on growth (e.g. Borensztein et al. 1998), or capital formation on economic growth (Levine and Renelt, 1992, and Blomstrom et al. 1996). The financial inflows provide the opportunities to accelerate economic growth by potentially raising the rate of capital accumulation. However, external inflows may be used to raise current consumption or to increase reserve accumulation, and that, in this instance, the effect of financial inflows on growth may be reduced. It is, therefore, important to examine to what extent external financial inflows contribute to capital accumulation, after having controlled for the effects of domestic sources of financing.

Third, with a sample size of 60 developing countries estimation is conducted by disaggregating the countries into three income groups of low, lower-middle and upper-middle

countries. Depending on the level of institutional capability, the bureaucratic efficiency, technological capability and the quality of labour, financial inflows affect domestic output differently. Although these country-specific environments can be, in part, captured by specifying proxy variables as found in much of the empirical literature, it may be more robust in estimating the model across different income group countries. Finally, both official and private financial flows are separately specified in the empirical model. Typically, many existing studies on the financial flows tend to concentrate on either private or official inflows. For example, Bosworth and Collins (1999) investigated the effect of financial flows on investment by types of financial flows, however, official inflows were not considered.

In sum, the central issue in this paper is the effect of disaggregated capital flows on investment, and that of investment on per capita GDP growth for 60 developing countries disaggregated according to their level of income. Empirical results found in this paper are broadly in line with the model prediction. Evidence reveals that private FDI inflows exert beneficial effects on capital formation regardless of the income level of host economy, whereas official inflows (ODA) contribute to increasing physical capital formation in the upper and lower middle income groups, however, not in the low income group of countries. Evidence also reveals that human capital formation has a positive impact in the middle income countries, but not in the low income economies possibly reflecting low level of education and out-migration of educated workers.

This paper is organised as follows. The following section will be tracing the analytical framework and the methodological issues behind the long-term growth. The third section presents an empirical methodology and data used for estimation. Empirical results are presented in the fourth section. The last section concludes the paper.

2. An analytical synthesis on long run growth with foreign capital

The endogenous growth models developed by Lucas-Romer extend the old neo-classical model by emphasizing the role of endogenous factors (i.e., human capital stock and R&D activities) as the main engines of economic growth. While early neo-classical models assume total factor productivity growth (or technical progress) as exogenously given, the newer endogenous growth models attribute this component of growth to the 'learning by doing' effect occurring between physical and human capital, which result in increasing returns to scale in production technology (Lucas, 1988). The most distinctive difference between the neo-classical exogenous and

endogenous growth theories is that the former assumes constant returns to scale with diminishing marginal productivity of capital per capita (MP_K) (Solow, 1956), whereas the latter generally assumes constant or increasing returns to scale with non-diminishing MP_K. The assumption of non-diminishing MP_K provides a possible way to long-run sustained growth in endogenous growth theories. These theories of endogenous economic growth stress the point that the opening up of the investment opportunities under a liberalised market-friendly economy brings about high economic growth. Besides, the financing gap model of the World Bank which is offered as an alternative policy framework for growth believes that growth of real output is related to total investment, where investment is considered as one of the demand factors in determining growth.

A wide range of endogenous growth models has treated human capital as a critical factor in determining growth rate of output (Lucas, 1988). It is an important source of long-term growth, either because it is a direct input into research (Romer, 1990) or because of its positive externalities (Lucas, 1988). Policies that enhance public and private investment in human capital, therefore, promote long-run economic growth. The inclusion of human capital variables in endogenous growth models are intended to capture quality differences in the labour force, as non-physical capital investment increases the productivity of the existing labour force. They commonly relate to education and are measured by an index of educational attainment, by mean years of schooling, or by school enrolment (Barro and Lee, 1993).

Besides, as GDP growth could be demand-constrained – for example, the demand shock following the Asian financial crisis of 1997-98 due to loss of consumer and business confidence leading to output collapse – there is room for theoretical exploration in explaining the growth processes by considering both domestic and foreign capital as demand-induced factors, in addition to the supply-driven forces in expanding productive capacity.[5] Thus, as the expansion of productive capacity cannot take place without a prior expectation of appropriate demand growth, it makes sense to integrate financial capital as one of the key determinants of demand growth. In this context, Paul and Truong (2004) examine the economic implications of institutional arrangements by which foreign investors are required to reinvest a certain percentage of their capital within the host country, and show theoretically that foreign capital inflow can produce long-lasting economic benefits to the host country only when the foreign capital reinvestment rate is sufficiently greater than the host country's saving rate.

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[5] It is worth mentioning the supply-side neo-classical propositions that demand has only a transitory impact on the utilization of resources and that the development of these resources (and hence potential output) over time is independent of demand are mere abstractions (Setterfield, 2002).

This brings another crucial point in the endogenous growth literature linking the relationship between the evolution of the financial system and development of the real economy, which suggests that financial development may promote productivity growth as a result of better screening and monitoring. One of the key measures of financial market deepening is domestic credit to the private sector that can affect economic activity in many ways.[6] It may contain at least two types of information about the process of financial intermediation. First, changes in credit may reflect an inability of financial intermediaries to make loans perhaps due to changes in monetary policy. In this case, firms, which are unable to obtain funds in the capital market may become credit-constrained leading to lower levels of investment. Second, changes in credit may reflect shocks to the intermediation system itself. Financial deregulation, financial innovations, or changes in the solvency of borrowers or lenders have implications for economic activity that may be transmitted through changes in the quantity of credit. The above analysis suggests that both monetary and financial variables are crucial determinants of economic growth, along with considering the role of physical and human capital formation.

Technically, the ideas in such a complicated set-up can be presented in a simple setting to bring out a model of growth with foreign capital. Following the standard endogenous growth approach (Rebelo, 1991), a given country's production can be characterised by the augmented aggregate production function (Y), homogenous of degree one with respect to physical and human capital, as

$$Y_t = AK_t^\gamma (HL)_t^\eta \text{ and } HL = E^\delta \Rightarrow \frac{Y}{E} = A\left(\frac{K^\gamma}{E^{1-\delta\eta}}\right) \Rightarrow y = Ak^\gamma \text{ if } \gamma = 1 - \delta\eta$$

Here y is real output per unit of human capital, L is raw labour input, HL is the average level of human capital indicating skilled labour, which is more likely to improve productivity, A is technical progress or total factor productivity (TFP), which is exogenous and different across countries, that is, low in low-income countries, E is the measure of education level, δ is the return to level of education. In general, the endogenous growth models require $\gamma + \eta\delta \geq 1$. Assuming $\gamma = 1 - \eta \Rightarrow 1 + \eta(\delta - 1) > 1$. For increasing returns to exist, this relation implies $\delta > 1$ for endogenous growth being driven by human capital, otherwise there would be constant returns. As the economy may be growing over time, it is convenient to focus on physical capital

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[6] Another measure could include equity market capitalization. Such data, however, are limited across all our sample countries and over the sample period, which is partly due to the underdeveloped capital market in many of the sample countries, especially in the earlier sample period. Instead we concentrate only on the private sector domestic credit.

stock per unit of human capital. Assuming the capital stock depreciates at the rate ψ, the evolution of k (K/E) is given by the following:

$$\dot{k} = \frac{I}{E} - \psi k - kh , \text{ where } h = \frac{\dot{E}}{E}$$

In the long-run, $\dot{k} = 0$. That is, $k = \dfrac{I}{(\psi + h)E} \Rightarrow K = \dfrac{I}{\psi + h}$. This long-run relation implies that as human capital growth increases, physical capital stock per unit of human capital remains constant. Now substituting the steady state level of K in the production function, we write:

$$Y_t = A\left(\frac{1}{\psi + h} I_t^{\gamma}\right)\left(E^{\delta}\right)_t^{\eta}$$

With logarithmic transformation and writing $\ln Y = \ln Y_0 + \Delta \ln Y$, the growth equation can be written as

$$\Delta \ln Y = -\ln Y_0 + \ln A + \frac{\gamma}{\psi + h}\ln I + \eta \delta \ln E \qquad\qquad [1]$$

There are two sources of financing this domestic investment (I). One is domestic savings, defined as a part of the gross national disposable income that is not consumed. Foreign savings can serve as a complementary source of financing investment outlays. From national income accounting reflecting the demand side, we can write:

$$I = sY + (M - X)$$

where s is the domestic savings rate. All the variables are expressed in real terms. Thus real trade deficit can equal real foreign capital inflows for balance of payments equilibrium:

$$M - X = F \quad \Rightarrow I = sY + F$$

where, F is the net real foreign inflows, including both official and private capital flows.

Foreign capital is disaggregated into official (F_{OF}) and private (F_{PF}) capital, implying that $F = F_{OF} + F_{PF}$

Upon substitution of F, the real investment can be rewritten as:

$$I = sY + F_{OF} + F_{PF} \qquad\qquad [2]$$

Further decomposition of private foreign capital can give us the following relation:

$$F_{PF} = FDI + OFI$$
$$OFI = \beta \Delta DC_P + \mu REXC \qquad\qquad [3]$$

where FDI refers to direct foreign investment implying long-term investment and OFI denotes other foreign investment mainly the short-term flows. It is important to distinguish between the long-term and short-term private capital flows, and explore their differential

effect on growth. In particular, FDI consists of not only capital *per se*, but also management skill, know-how and technology, and that FDI generates technological diffusion from the developed countries to the developing countries raising economic growth (Balasubramanyam et al., 1996; Borensztein et al., 1998; and Choe, 2003). It is assumed that short-term foreign capital flows, including portfolio investment and foreign bank lending, depend on the development of domestic financial market, as reflected through the size of the private sector credit market (ΔDCp), and the real exchange rate with respect to the US dollar[7]. The real exchange rate here is expected to reflect the relative price impact on short term foreign exchange inflows including trade flows.

Substituting [3] into [2], we have

$$I = sY + F_{OF} + FDI + \beta \Delta DC_p + \mu REXC \qquad [4]$$

The equations [1] and [4] are used for estimation.

In equilibrium we assume that the process of capital accumulation is investment driven, recognizing saving as a residual that adjusts to accommodate the level of investment spending. Gross capital formation describing the physical endowments is the most common variable in studies of endogenous growth. Investment as opposed to the accumulated stock of capital can be used because it is an important vehicle for technological diffusion due to the vintage effect of new capital. Further, during fiscal adjustments government capital spending is indeed reduced more than other categories of government spending and this decline in public capital spending has important growth retarding effects. The net effect will be reflected in aggregate investment. The official inflows can contribute to growth: first, by relaxing financing constraints (saving, foreign exchange and fiscal gaps), it can finance investment in physical and human capital; second, the official lenders could use aid to encourage policy reform – the so-called policy conditionality (see Morrissey, 2004).

3. Data and Econometric Issues

Data are collected from World Development Indicators, except private sector's domestic credit for all selected countries and prices for Brazil and Tunisia, which are collected from IFS. The data cover 60 countries over the period of 1970-2003 (34 years). Using the annual panel data, estimation is conducted for three income groups by classifying the developing

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[7] See Bosworth and Collins (1999) for the study of different types of private capital flows.

countries into the low, lower-middle and upper-middle income countries[8]. It is argued that the impact of financial inflows on investment and domestic output varies according to the political and macroeconomic environment. For example, it is empirically found that aid only contributes positively to private investment when certain macroeconomic conditions are met in the local economy (see Dollar and Easterly, 1999). In order to address any different impact of financial flows on growth, developing countries are divided on the basis of their level of income. It is assumed that the institutional conditions and monetary and real sector environments share some common features among similar levels of income. This is plausible, for example, the operation of financial sector in Bangladesh may be more similar to that of Pakistan in the same low income group, than that of Malaysia in an upper middle income group[9].

The selected countries are based on data availability; more than half of the countries have a full data set of 34 years, and the majority have data more than half of 34 years. Appendix 2 reports the selected countries in each income group. Countries are divided according to World Bank's 2003 GNI per capita. It is pointed out that the selection of sample countries based on data availability causes selection bias. The selection bias may be circumvented by controlling such factors as macroeconomic and political environment, and financial development, which are specific to individual countries. Burnside and Dollar (2000) developed an index of three policies (budget surplus, the inflation rate and the openness), known as the Burnside and Dollar policy index to capture the quality of a country's policies and macroeconomic environments. This is based on the argument that growth of developing economies depends, to a large extent, on their own economic policies.[10] The model developed here may broadly capture these effects by including other control variables such as real exchange rates, savings rates and education, along with trade openness as an instrument.

The econometric model specification based on equations [1] and [4] are as follows:

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[8] We estimated the model using the full sample of 60 countries with intercept and slope dummies, but the overall results were less informative and hence we decided not to present the overall results so as to minimise space. As we have different set of countries in each sub-sample, it is better to use only the common countries (namely low income, lower middle and upper middle) for comparability. Moreover, given five and seven variables for the growth and investment equations respectively, the full sample model requires total of fifteen and twenty-one variables with dummies. There could be the possibility of multicollinearity, which might make precise estimation of some parameters difficult.

[9] Besides, the empirical results supported our approach, since income-group specific results were evident in terms of foreign capital as set out in Section 4.

[10] See, for example, Bleaney, 1996.

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$$\varDelta \ln y_{i,t} = \beta_0 - \beta_1 \ln y_{i,t-1} + \beta_2 \ln PROD_{i,t} + \beta_3 \ln INV_{i,t} + \beta_4 \ln EDU_{i,t} + u_{i,t} \qquad [5]$$

$$\ln INV_{i,t} = \alpha_0 + \alpha_1 \ln SAV_{it} + \alpha_2 ODA_{it} + \alpha_3 FDI_{it} + \alpha_4 \ln \varDelta DC_{it} + \alpha_5 \varDelta \ln REXC_{it}$$
$$- \alpha_6 (\ln REXC * \varDelta \ln P)_{it} + \varepsilon_{it} \qquad [6]$$

where y = real GDP per capita, $PROD$ = productivity (GDP/labour force), INV = real investment (real gross capital formation), EDU = literacy rate[11] (% of people aged 15 and above), SAV = real domestic saving, ODA = official development assistance as % of GDP, FDI = foreign direct investment as % of GDP, DC = domestic credit to the private sector, $REXC$ = real exchange rate, and $\varDelta \ln P$ = inflation (based on CPI). The dependent variable in equation [5] is the growth in real GDP per capita. The expected signs of the coefficients follow the theoretical model in the previous section, and are consistent with existing literature. Note that the interaction term between real exchange rate and inflation is also specified as an additional regressor. Given a possible trade-off between inflation and investment, we intend to capture the combined effect of a situation of low real depreciation and high inflation, through an interaction term, as this situation could lead to reserve loss and currency crisis in a country. The descriptive statistics for all the variables are given in Appendix 1.

Prior to estimation, unit root tests are carried out to examine the stationarity properties of the variables, to ensure that incorrect inferences are not made due to spurious regression. We employ the two types of panel unit root tests of Levin et al. (2002) and Im et al. (2003). Levin et al.'s test incorporates a degree of heterogeneity by allowing for fixed effects and unit specific time trends. Im et al. allow for heterogeneity of the coefficient on the lagged dependent variable[12].

Table 1 shows that the variables in levels namely lny, lnDC and ln$REXC$ are found to be insignificant at the 5% level by the Im et al. (2003) panel test, implying that they are non-stationary. Levin et al. (2002) test also indicates the insignificance of ln$REXC$. The first difference of these variables rejects the null of unit root. It follows that the variables are characterised as integrated of order one. For other variables, the test results indicate stationarity in levels. These results are consistent with the models [5] and [6], in that the

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[11] The secondary school enrolment was initially thought of as the proxy for human capital. However, with very poor data availability for many selected countries, where it starts from 1990 onwards, and if before, it is only available for a 5-year frequency, thus inclusion of this proxy was not considered.

[12] Levin et al (2002)'s null and alternative hypotheses are $\rho_i = 1$ where $i = 1, \ldots N$ and $\rho_1 = \rho_2 = \ldots = \rho_N < 1$ respectively. The alternative hypothesis assumes the same degree of stationarity across countries. Im et al. (2003) estimate the Augmented Dickey Fuller test equation for individual countries and take the average of the t-ratio (t-bar test).

stationary variables are specified in levels, while the non-stationary variables are first differenced.

The model [5] and [6] are single equations. There could be concerns about simultaneity bias in our regressions due to potential endogeneity. The current GDP growth may be influenced by past investment, or GDP growth may impact on investment rates through its effect on saving rates as in equation [5]. It is also argued that growth may be an important determinant of FDI, for example, a more rapidly growing economy provides greater profit opportunities than a slowly growing economy. The endogeneity test between the two equations is conducted based on the Durbin-Wu-Hausman test of Davidson and MacKinnon (1993). The results are in favour of endogeneity between growth and investment for all income groups[13]. We have carried out a preliminary exercise with a panel simultaneous equation of growth and investment models. The simultaneous estimation does not seem to perform well with anomalous signs on some of the coefficients. This may be, in part, due to the small sample size relative to the total number of *twelve* explanatory variables. Moreover, in using a system method to consistently estimate coefficients, all equations in the system must be properly specified, implying that the instruments must be exogenous (Wooldridge 2002). Therefore, we do not pursue a simultaneous solution[14].

The models are, therefore, estimated by GMM (generalised method of moments) techniques. GMM estimators are used to deal with the problem of simultaneous causation between the two dependent variables by taking the lagged endogenous variables and all variables on the right hand side of the equation (5) and (6) as instruments (Arellano and Bond, 1991). A trade variable (Trade) is also used as an additional instrument, since trade openness can be an intermediate variable between investment and real exchange rate. The GMM estimator belongs to a class of estimators, which minimize a criterion function. GMM yields a robust estimator in that it does not require information of the exact distribution of the disturbances. It is postulated that the disturbances in the equations are uncorrelated with a set of instrumental variables, and the GMM estimator selects parameter estimates so that the

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[13] First the GDP growth equation [5] is estimated with additional regressors of all explanatory variables in the investment equation [6]. The investment equation is, then, estimated with the residuals of the growth equation as an additional regressor. If the coefficient of the residuals is significantly different from zero, then there exists an endogenous relationship between the two dependent variables. The t-ratio of the coefficients are as follows:

Income groups	Low	Low-middle	Upper-middle
t-ratio	1.907	1.897	3.821
Prob.	0.057	0.058	0.000

[14] Note that to the best of our knowledge, there is no empirical literature existing with the panel simultaneous estimation in the study of growth, investment and foreign capital.

correlations between the instruments and disturbances are almost zero, as defined by a criterion function. By choosing an appropriate weighting matrix in the criterion function, GMM can be made robust to heteroskedasticity and autocorrelation of an unknown form.

4. Empirical Findings

The GDP growth and investment equations for each income group are presented in Table 2 and 3 respectively. The joint significance of coefficients is examined by the F- and Wald tests, which decisively reject the null of insignificance. Over-identifying restrictions are used to test for the validity of instruments, and a test of serial correlation of error terms is used to detect the presence of unobserved individual effects. The over-identification tests indicate that the null is not rejected in all cases, suggesting that the instruments adopted are valid. The first-and second-order serial correlation test statistics mostly indicate that little unobserved individual effects remain in the GMM estimation results, though middle incomes groups in the growth equation tend to show the presence of serial correlation. Overall these tests seem to be satisfactory[15]. The models exhibit a relatively high goodness of fit, especially, the R^2 in the investment equation is very high at above 90%, indicating the strength of the explanatory power. The estimates are mostly well-determined, and the sign on the coefficients is broadly consistent with our model prediction.

In the growth equation (Table 2), the lagged GDP per capita has a negative impact on the rate of GDP growth, and high productivity and investment are associated with faster growth in the GDP per capita, as predicted. The robust finding is the positive effect of capital formation on economic growth.[16] In Table 2, the elasticity of lagged GDP in the low income group is almost unity, which is larger than those in the middle income countries at –0.42 and –0.58 respectively. This implies that the economies in the low income group adjust much faster than middle income economies to the long-run level of growth rate, which is a reasonable result. Given a relatively high elasticity of 0.96, the contribution of labour productivity to economic growth is larger in the low-income group than that in the middle-income countries, implying that economic growth is more sensitive to technological changes. This result partly supports Easterly and Levine (2001) that the residual or TFP accounts for

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[15] We also estimated the model by OLS, and a closer inspection indicates that the GMM coefficients were, in general, larger in size compared to their OLS estimates, indicating endogeniety problems in the OLS estimates.
[16] Blomstrom et al. (1996) find that per capita GDP growth is more closely related to subsequent capital formation than to current or past capital formation, arguing that the effect of the fixed investment as the key to economic growth is weak. Their work is, however, based on the simple Granger-causality test and bivariate regression without taking account of country-specific factors and other control variables.

most of the growth differences across countries. Besides, productivity can reflect the impact of population growth. The high coefficient in the low income countries suggests that as population growth rate increases, it generates an increase in the stock of labour causing a decline in productivity, thus economic growth declines more in low income countries than in middle income countries. Further, productivity can also reflect the differences in social infrastructure including differences in government institutions associated with regulations, red tape and bureaucratic restrictions, and other start-up business costs.

Another interesting finding in Table 2 is that education (literacy rate) is significant with a negative sign in the low income group, whereas it is significantly positive in the lower- and upper-middle income group. Note that the level of education is very low in low income countries, and that there is not much variation across these countries. Also note that skilled workers from many very low income countries could migrate to work in other countries. These may explain no positive correlation between the level of education and economic growth. Besides, it is possible that literacy rate is relatively high among military force, and that if there is a positive correlation between the level of education and the presence of armed forces, internal conflict may be the consequence. This should substantially deter economic growth as is often found in some of the African countries[17]. In this respect, the significant negative impact is plausible in very low income countries. On the other hand in the middle income groups, there may be substantial variation in the level of education among countries with less migration and armed internal conflicts, and that higher level of education appear to lead to the higher rate of growth in per capita GDP[18].

In Table 3, a highly significant coefficient on domestic saving across different group of countries indicates a strong positive relationship between financial saving and investment. This means countries that have high savings rates will accumulate more capital and thereby more output per worker, *ceteris paribus*. It should be noted that the elasticity of saving in the low income group is smaller to those in the middle income groups. In the developing countries, it is often argued that the real interest rates tend to be negative deterring much of the capital accumulation – the so-called financial repression (see Arestis *et al.*, 2002). The existence of repressed financial intermediaries may be reflected in the lower level of contribution of domestic credit to capital formation in the low income-group countries, where

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[17] We thank an anonymous referee for this point.
[18] In general, empirical literature tends to find a positive effect of education. For example, in the growth study by Borensztein et al. (1998), the effect of education on per capita GDP is found to be positive based on the panel data for the period 1970-89 over 60 developing countries. Li and Liu (2005) also find the positive effect of education. Both study used the secondary school attainment constructed by Barro and Lee (1993).

the coefficients are statistically insignificant with a wrong sign, while they are significant in the middle income groups.[19] Insignificant or incorrect sign on the coefficient of domestic credit may also reflect the degree of under-developed financial markets in the low income countries as compared to middle income groups, along with subsidised lending draining into the priority sectors, such as agriculture, small business and small transport operations, which may fail to generate new investment projects.

In terms of external financial flows, ODA (official development assistance) is significantly positive in the lower-middle and upper-middle group of countries. On the other hand, the effect of aid on the capital formation seems to be weak in the low income group as the coefficient is not significant. There are a large number of empirical studies on the effectiveness of ODA (or aid), but the empirical results are inconclusive. Overall, although an aid-investment-growth link is found to be weak in the financing gap model, it is found to be significant in a neoclassical setting (e.g. Boone, 1996, Easterly, 1999, and Lensink and Morrissey, 2000). An aid-growth link is generally found to be strong in the multivariate regressions, where the target variable is regressed on a range of hypothetical explanatory variables (Burnside and Dollar, 2000, Collier and Dollar, 2001, and Hansen and Tarp, 2001).[20]

Generally, in order for ODA to affect output most effectively, countries need to be equipped with reasonably developed institutions and legal systems. For example, Evrensel (2004) argues that there are divergent dynamics that have taken place among developing countries, for example, middle- and high-income countries have more incentives to improve their economic policies and introduce reforms, whereas this is less so for low-income countries. A good macroeconomic policy environment could imply improving institutions, which could enable aid to be smoothly converted to production capability[21]. In this respect, our results are not implausible, in that aid is ultimately contributing to the growth in the

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[19] This result is similar to the positive and significant effect of real balances on economic growth found in Ghatak (1997) for an individual country – Sri Lanka.

[20] See Dalgaard et al. (2004) and Mallick and Moore (2005) for a detailed survey of existing studies in the aid-growth literature.

[21] For example, as outlined in Section 3, Burnside and Dollar (2000) specifies the Burnside and Dollar policy index to interact with foreign aid and aid multiplied by the policy index term together with other variables of macroeconomic, financial system and political instability in the growth regressions. Using a panel of 56 countries from 1970-73 until 1990-93, they found that aid contributed positively to growth, but only in good policy environments. Collier and Dollar (2001) used the World Bank's Country Policy and Institutional Assessment (CPIA) as the measure of policies, which capture the extent to which a country has a good institutional and policy environment for long-term growth and poverty reduction. With the data set covering 62 developing countries from 1974-1977 to 1994-97, growth was regressed on exogenous variables including the interaction of policy and aid (i.e. ODA x CPIA). The coefficient of the interaction of policy and aid was positive and significant, supporting the effectiveness of aid with a good policy.

middle income groups, where countries are framed by better macroeconomic and policy climate than those in the low income group. Moreover, the positive impact of aid on growth may not hold in very poor countries, where aid could be misallocated into financing government consumption expenditure or reserve accumulation (in particular when the exchange rates are fixed) as opposed to increasing productive capital formation for economic activities. These factors are perhaps stronger in the low income group, as reflected in the insignificant effect of aid.

While ODA has different effects among the countries of different income levels, FDI is statistically significant with a correct positive sign across all income groups. Empirically, the impact of FDI on economic growth has remained controversial. Our results are in line with those studies of Blomstrom et al. (1996), Balasubramanyan et al. (1996) and Borensztein et al. (1998), who observe a positive impact. Durham (2004) finds a negative relationship between FDI and growth.

It is often argued that the effect of FDI is contingent on the 'absorptive capability' of host countries including institutional and technological capability (Borensztein et al 1998, and Durham, 2004).   Empirically, there is evidence that the bulk of FDI occurs across technologically advanced economies (DeMello, 1999), where FDI is more likely to generate benefits for economic growth by increasing capital formation. In view of this, the significant positive effect of FDI is a robust finding for the upper-middle income group, where the absorptive capability may be higher than in lower income countries.

With respect to the lower-middle and low income groups, which generally lack in the absorptive capability, the significant effect of FDI may be counter-intuitive. However, note that the effect of investment on the growth rate is much less than that in the upper-middle income group, as evidenced in Table 2 where the coefficient of investment is 0.018 and 0.005 in the low and lower-middle groups respectively, as compared with 0.072 in the upper-middle income countries. This implies that although capital can increase with the inflow of FDI, the contribution of the capital formation to the growth rate is relatively low, in part due to lack of absorptive capability in the developing countries with lower level of income.

With regard to the impact of real exchange rate on investment, the positive significant coefficient in the case of middle income countries suggests that trade liberalisation policies with respect to capital goods imports may have helped bring about a fall in the relative price of capital goods, leading to an increase in the rate of investment in equipment and economic

growth.[22] The coefficient on the interaction term of real exchange rate and inflation rate has been found to be negative and significant. This implies that developing countries tend to have macroeconomic instability due to high inflation thus reducing the effectiveness of external competitiveness as reflected in the interaction variable. This suggests macroeconomic stability should be considered as one of the key drivers of economic growth in developing countries[23].

5. Conclusion

This paper investigated the external financial flows-investment-growth nexus within the framework of an endogenous growth mechanism for developing countries. Considering an endogenous growth model driven by physical and human capital formation along with monetary and financial factors, the finding here rejects the possibility of neoclassical conditional convergence hypothesis, as countries will grow faster when capital formation in both physical and human capital increases.

Overall, it is found that there is a strong complementarity connection between financial inflows and economic growth through the conduit of capital formation, suggesting that external finance does positively contribute to economic growth. The hypothesis set out in this paper that the opening up of the investment opportunities via foreign capital brings about high economic growth, is, therefore, supported.

The income-level specific features are observed in the lagged GDP, education and financial flows. The long-run equilibrium level is reached much faster in the low income countries. There is a valid effect of human capital on growth in the middle income groups. It is also found that while private flows (FDI) are beneficial for domestic investment at any level of income groups, official flows (ODA) are effective in the middle income groups, but not in the low-income group partly due to misallocation of such flows into financing government consumption needs rather than investment projects. In particular, FDI shows the strongest link to aggregate investment, and that may be the preferred type of flows for promoting growth in developing countries.

A number of policy implications can be drawn from the empirical results. First, given a positive effect of education in the middle income groups, policies that enhance public and

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[22] See, for example, Sen (2002), who found strong support for this mechanism in the case of India.
[23] Li and Liu (2005) also find a trade-off between inflation and FDI. However, in the empirical study for IMF stabilization program, inflation is not particularly well-determined in a growth model, for example, Dicks-Mireaux et al. (2000) fail to obtain significant effects of inflation.

private investment in human capital promote long-run economic growth. Second, FDI is to be further encouraged for economic growth in developing countries irrespective of their income level. However, as the indirect impact of FDI on growth through their contribution to investment could be weaker in the lower income group countries, the improvement of absorptive capacity in the host economies needs to be emphasised for these countries for greater effectiveness of FDI on economic growth. Finally, there is need for a more cautious approach in delivering ODA in the lower income countries. Maintaining macroeconomic stability and developing a conducive policy-environment are the prerequisites in order to effectively convert the official aid to stimulate higher private investment including foreign private capital inflows.

Devarajan et al. (1996), Easterly and Rebelo (1993) and Otto and Voss (2003) investigated the effect of public investment on economic growth. The services from public investment projects are likely to differ from those of the private investment and that they suggest that an aggregate investment measure may be inappropriate. In terms of future research, it would be worthwhile to investigate the effect of external financial flows on public investment and thereby growth across different group of countries.

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Appendix 1
Descriptive statistics

	$\Delta \ln y$	$\ln PROD$	$\ln INV$	$\ln EDU$	$\ln SAV$	ODA/GDP
Mean	0.0131	10.4049	20.7832	4.0614	20.4455	4.5300
Median	0.0177	10.1149	20.7372	4.2598	20.2242	1.9224
Max.	0.2407	15.3506	30.7045	4.5987	30.4881	62.8655
Mini.	-0.3387	4.9409	13.8446	1.7826	12.2936	-0.5686
St. Dev.	0.0499	2.2777	2.7128	0.5183	2.8775	5.8519
Kewness	-0.6849	0.1759	0.7218	-1.4385	0.6409	2.3450
Kurtosis	6.8599	2.6096	4.4840	5.1454	4.1559	12.5428
Obs.	2013	2013	1861	1931	1730	1986

	FDI/GDP	$\Delta \ln DC$	$\Delta \ln REXC$	$\ln REXC*\Delta \ln P$
Mean	1.4979	0.2313	0.0096	0.6232
Median	0.8099	0.1702	-0.0017	0.2619
Max.	51.2847	5.2491	3.2780	12.6530
Mini.	-12.2084	-1.4551	-2.2264	-11.0550
St. Dev.	2.5957	0.3710	0.2242	1.2110
Kewness	6.2047	5.5959	1.8269	3.7794
Kurtosis	100.4553	54.4976	44.9046	32.7925
Obs.	2019	1849	1839	1840

Appendix 2

Low-income countries: 24 countries
Bangladesh, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Cote d'Ivoire, Ethiopia, Ghana, Haiti, India, Kenya, Lesotho, Malawi, Mali, Mauritania, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Senegal, Togo, Zambia.

Lower-middle-income countries: 23 countries
Algeria, Bolivia, Brazil, China, Colombia, Dominican Republic, Ecuador, Egypt, El Salvador, Guatemala, Honduras, Indonesia, Jamaica, Jordan, Morocco, Paraguay, Peru, Philippines, Sri Lanka, Syrian Arab Republic, Thailand, Tunisia, Turkey.

Upper-middle-income countries: 13 countries
Argentina, Belize, Botswana, Chile, Costa Rica, Hungary, Malaysia, Mauritius, Mexico, Oman, Panama, Trinidad and Tobago, Uruguay, Venezuela, RB.

The groups are low income, US$765 or less; lower middle income, US$766 - 3,035; and upper middle income, US$3,036 – 9,385.

Table 1: Panel Unit Root tests (1970-2003)

	Levin, Lin and Chu (2002)	Prob.	Im, Pesaran and Shin(1997)	Prob.
Levels				
Lny	-2.607 *	0.004	-1.452	0.073
ln$PROD$	-3.364 *	0.000	-3.316 *	0.001
ln INV	-3.848 *	0.000	-2.130 *	0.017
lnEDU	-29.613 *	0.000	-18.733 *	0.000
lnSAV	-4.505 *	0.000	-5.038 *	0.000
ODA/GDP	-8.004 *	0.000	-6.691 *	0.000
FDI/GDP	-2.568 *	0.000	-6.504 *	0.000
lnDC	-6.178 *	0.000	1.840	0.967
ln$REXC$	0.064	0.525	0.418	0.662
ln$REXC*\Delta \ln P$	-9.225 *	0.000	-12.585 *	0.000
First Differences				
Δln$y$	-18.626 *	0.000	-21.373 *	0.000
ΔlnDC	-11.642 *	0.000	-15.491 *	0.000
Δln$REXC$	-7.428 *	0.000	-14.629 *	0.000

Null: unit root

* Significant at the 5% level.

Table 2: GDP growth equation by GMM for each income group (1970-2003): Dependent variable $\Delta \ln y$ (growth)

	Low	(t-ratio)	Lower-middle	(t-ratio)	Upper-middle	(t-ratio)
Constant	-0.441	(-4.061)	-0.637	(-3.133)	-1.931	(-7.400)
ln y_{t-1}	-1.007	(-10.865)	-0.426	(-7.333)	-0.589	(-11.440)
ln $PROD$	0.963	(9.389)	0.389	(6.178)	0.421	(9.072)
ln INV	0.018	(3.012)	0.005	(1.866)	0.072	(9.922)
ln EDU	-0.077	(-10.744)	0.119	(4.772)	0.377	(5.896)
F-test	83.390		31.304		46.057	
Wald test (df)	333.558 (4)		125.218 (4)		184.228 (4)	
Over-identification (df)	1.818 (7)		10.779 (7)		1.587 (7)	
LM serial (1)	0.067		44.696		9.57	
LM serial (2)	0.197		45.066		9.119	
Adj. R^2	0.701		0.424		0.523	
Countries	24		23		13	
Observations	503		642		345	

Notes: t-ratio is in parentheses. F-test and Wald test: joint significance of coefficients. LM: Lagrange Multiplier serial correlation test. Instrument variables: constant, ln SAV, ODA/GDP, FDI/GDP, Δln DC, ln $TRADE$ (trade openness defined as exports plus imports as a percent of GDP), Δln $REXC$, $\Delta \ln P$, ln $PROD_{t-1}$, ln EDU_{t-1}, ln INV_{t-1}, $\Delta \ln y_{t-1}$. Critical values of χ^2 distribution at a 5% significance level (df): 3.84(1), 5.99(2), 9.49(4) and 14.07(7).

Table 3: Investment equation by GMM for each income group (1970-2003): Dependent variable ln*INV* (investment)

	Low	(t-ratio)	Lower-middle	(t-ratio)	Upper-middle	(t-ratio)
Constant	4.440	(2.507)	-0.575	(-1.064)	0.668	(1.709)
ln *SAV*	0.831	(9.779)	1.033	(40.121)	0.960	(50.280)
ODA/GDP	0.015	(0.883)	0.046	(5.516)	0.027	(2.346)
FDI/GDP	0.042	(1.878)	0.059	(4.284)	0.020	(2.010)
Δln *DC*	-0.397	(-0.717)	0.508	(3.525)	0.392	(2.182)
Δln *REXC*	-0.674	(-1.213)	0.316	(1.060)	0.182	(1.053)
ln*REXC*$*\Delta$ln *P*	-0.988	(-2.560)	-0.183	(-3.550)	-0.142	(-2.919)
F-test	20.170		300.773		584.113	
Wald test (df)	121.023 (6)		1804.636 (6)		3504.678 (6)	
Over-identification (df)	2.122 (5)		6.300 (5)		5.425 (5)	
LM serial (1)	4.278		3.445		0.687	
LM serial (2)	2.441		2.620		5.946	
Adj. R^2	0.821		0.988		0.919	
Countries	24		23		13	
Observations	473		634		342	

Notes: t-ratio is in parentheses. F-test and Wald test: joint significance of coefficients. LM: Lagrange Multiplier serial correlation test. Instrument variables: constant, ln INV_{t-1}, Δln y , ln PROD, ln EDU, ln SAV_{t-1}, ODA/GDP_{t-1}, FDI/GDP_{t-1}, Δln DC_{t-1}, Δln $REXC_{t-1}$, Δln P_{t-1}, ln $TRADE_{t-1}$. Critical values of χ^2 distribution at a 5% significance level (df): 3.84(1), 5.99(2), 11.07(5) and 12.59(6).