Finance-Growth Nexus in open economies with outliers*

Alessandra Dal Colle Stievano†

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Abstract

This paper aims to offer a contribution to the empirical literature on the links between financial and economic development.

In the investigation of the finance-growth nexus for 18 non-OECD countries plus Mexico and Korea, the paper firstly introduces an indicator of restrictions on the establishment of foreign banks. Secondly, it links financial development the capital–output ratio rather than the level of income *per se*, implicitly assuming that a sound financial development has to be relatively capital-intensive. Futhermore, a new procedure is systematically applied to take proper consideration of crisis periods with dummies.

The paper finds that in the long run financial development relationship most countries support the capital-output ratio specification. Also, "fairly liberal" countries show a negative contribution of financial openness to financial development. The non-linearity between finance and growth seems to be confirmed by the growing elasticity of the capital output ratio in relatively developed countries. Finally, some large countries seem to support the endogenous growth hypotheses while most African countires turn out as "cursed", since neither accumulation nor openness can explain their growth (or, rather, lack thereof).

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†Banca Intesa Research Department, Milan (Italy) and CeFiMS, SOAS, University of London (UK). Email: 115147@soas.ac.uk

1 Introduction

The empirical literature on the links between financial development and economic development/growth is wide and very differentiated and there is no single way to classify it. Clustering the literature around some common themes one can find among the main researched topics:

- the importance financial development in the process accumulation and hence in economic development/growth
- the non linearity of the relationship between financial and economic development
- the relationship between trade- or financial openness and economic development/growth.

A cornerstone of empirical studies Rousseau - Sylla (2001) find a robust correlation between financial factors and economic growth that is consistent with a leading role for finance for 17 countries with data from 1850 to 1997. This is further supported by Harrison-Sussman-Zeira (1999) who find a feedback effect between the real and the financial sector that helps to explain international differences in ouput per capita. Luintel - Khan (1999) using the VAR technique find two cointegrating vectors identified as long-run financial depth and output relationship linking financial and economic development. They also find a negative contemporaneous correlation between the level of financial development (depth) and growth in per capita income in 7 out of 10 countries and a strong positive correlation between the levels of financial depth and per capita output in all sample countries. Beck-Levine-Loayza (2000) in their panel studies for 77 countries from 1960 to 1995 confirm an economically large and statistically significant relationship between financial development and both real per capita GDP growth and total factor productivity growth. In their study the positive link between financial intermediary development and both physical capital accumulation and private savings rates is however ambiguous since it is not robust to alterations in estimations techniques and measures of financial intermediary development.

A tentative explanation of such puzzle might lie either in differences in long run relationship and short-run dynamics on in the non-linearity of the relationship itself that is therefore not significantly picked up by standard estimation techniques. In fact, Loayza - Ranciere (2002) with a regression with 17 countries find a positive long-run relationship between financial intermediation and output growth co-exists with a, mostly, negative short-run relationship. Also, Deidda - Fattouh (2001) with a threshold regression find a positive relationship between the level of financial depth and economic growth for countries with high income per capita but no significant relationship for lower-income countries which is consistent with the non monotonic relationship implied in the model.

On the relationship between openness and financial development Rousseau - Sylla (2001), with the ratio of trade to GDP as a dependent variable, show that countries with more sophisticated financial systems engage in more trade and appear to be better integrated with other economies. Rappaport (2000), comparing the open-economy and closed economy versions of a calibrated model shows that openness to capital flows causes only a very small increase in the rate of per capita output growth. Alternative calibrations, which instead suggest a large effect of openness on growth, either generate strongly counterfactual closed-economy series or depend on the unrealistic assumption that individuals can borrow against future labour earnings. Also, on the more exquisitely financial side, Clarke-Cull-Martinez Peira (2001) through survey data and a database on bank regulation and supervision find that foreign bank penetration improves firm' access to credit. It is worthwhile underlining, however, that Buch (2000) with both cointegration and regression analysis finds that liberalisig regulation - EU's single market program and the Basle Capital Accord in particular - have had a positive impact on cross-border banking and the evidence is less convincing for capital account liberalisation as such.

In conclusion, the brief survey of the literature seems to support the view that financial development is linked to economic development/growth even if in no linear fashion. Furthermore, financial openness might be "good" for the economic development/growth but the different empirical definitions used in the literature are not able to support a robust case in favour of a positive effect of financial openness on economic and financial development.

In this paper the empirical analysis of the finance-growth nexus is attempted within a cointegration framework. The cointegrating relations aim to describe long run relationships between the level of financial and economic development rather than growth, even if the growth dynamics are implicitly considered in the lag structure of the time series model. In line with the empirical literature on financial development and growth credit to private sector as a percentage of GDP will be used as a financial development indicator.

Secondly, as in Clarke-Cull-Martinez Peira (2001) and Loyaza - Ranciere (2002) a composite indicator proxying financial openness will be introduced as an endxplanatory variable. Thirdly, given the volatility of variables for the sample countries and the consequent need of using dummies a newly developed specific technique has been used. And finally, in accordance with the simple model sketched in section 2, the cointegrating equation describing the long run equilibrium relation between financial development and the "the real economy" will be specified with a role for the capital income ratio rather than income per capita alone.

In what follows section 2 will specify the model, section 3 will briefly describe the data and attempt an interpretation of the stlylized facts around the links between finance and growth in open economies. Section 4 will sketch the cointegration methodology and results with a special reference to theoutlier detection and estimation procedure. In section 5 the conclusions will be wrapped up.

2 Model Specification

A non-linear relationship between financial and economic development where financial institutions endogenoulsy emerge has a significative tradition in theoretical models. The pillars of such models[1] can be summarised in

- standard 2-period OLG structure where individuals inelastically supply labour during the first period of life and receive a salary which is partly consumed and partly saved and the savings are deposited and receive a real interest rate R_t^d
- costant or increasing- return production function of the type

$$Y_t = \psi A_t K_t^{\beta} l_t^{1-\beta} \text{ or } \ln y_t = \psi + \beta_{2,3} \ln(k_t) \tag{2.1}$$

  where $k_t = \frac{K_t}{l_t}$ and $y_t = \frac{Y_t}{l_t}$. $A_t = k_t^{1-\beta}$ is an externality effect associated with capital accumulation (i.e. $\beta_{2,3} \approx 1$)and ψ is the exogenous productivity coefficient. The representative firm's demand for loans b_t stems from the equilibrium equation for the yield on loans

$$b_t|_{R_t^l = \frac{\partial Y_{t+1}}{\partial K_{t+1}}} = l_{t+1} k_{t+1} = \left(\frac{R_t^l}{\beta \psi A_{t+1}} \right)^{\frac{1}{\beta - 1}} \tag{2.2}$$

- firms have no capital endowment, they operate if and only if they are externally funded,
- banks fund themselves by issuing deposit contracts to households and have a fixed set up cost and non-linear variable costs. The representative bank's balance sheet can be thought of as

$$D_t = \int_0^{z_t} b_t dz + \int_0^{z_t} c(z) b_t dz + E = \int_0^{z_t} \left[1 + c(z) \right] b_t dz + E \tag{2.3}$$

where D_t are deposits, b_t is the amount of loans per firm, z_t is the bank's market size in the loan market and E is the fixed amount of physical resources consumed each period t to set up a bank.

Solving the model, an equilibrium relationship among the amount of credit outstanding in the system b_t, capital per capita k_t and the real interest rate R_t emerges and it is subsequently log-linearised as

$$\ln b_t - \ln y_t = \beta_{1,0} - \beta_{1,2} \ln y_t + \beta_{1,3} \ln(k_t) + \beta_{1,5} \ln(R_t) \tag{2.4}$$

[1] For details see amog others A. Dal Colle Stievano (2001) and L. Deidda - B. Fattouh (2001)

Therefore the credit/GDP ratio b_t/y_t should have a positive link with the capital/output ratio (i.e $\beta_{1,3} = -\beta_{1,2}$ and $\beta_{1,3}, \beta_{1,2} > 0$) and also an explicit positive relationship with the real interest rate.

In what follows for each country the estimation of a cointegration relationship of rank 2 will be attempted aimed at estimating enriched versions of (2.4) and (2.1) to take into account the effect of financial openness. ψ will be modelled as $\approx (\beta_{2,0} + \beta_{2,5} \ln(R_t))$.

3 Data Desciption

Inasmuch as financially open economies represent the focus of the analysis, the 20 countries for estimation have been selected among those analysed in M. Kono - L. Shuknecht (1998) [KS98 from now] where a long enough time series could be found in either in the May 2003 World Development Indicators [WDI03] or in Heston-Summers-Aten (2001), [PWT6.1]. Ideally the sample for each country includes 41 yearly observations from 1961 to 2001 of real income per capita (YC), real capital stock per capita (KC), real interest rate (RR), credit to private sector as a percentage of GDP (CR) as a financial development indicator and the financial openness proxy (OP). Details on sources and calculations for each variable in each country are summarised in Appendix A.

CR has been chosen rather than deposits on GDP because of both a better fit with the theoretical model chosen for reference and longer time series readily available from WDI03 that would have minimised calculation errors. CR has been similarly preferred to other frequently used measures of financial development such as M2/GDP since the focus of the estimation is the (hopefully) useful role of money as technology to trasfer value and give way to investment rather than money as a facilitator of exchange, which is best represented in M2.

The Restrictions on practices by Foreign Establishments (RFE) indicator is derived by KS98 from the GATS Schedules[2]. GATS commitments are minimum guarantees of market access or national treatment and current policy cannot be reversed to standards below those subscribed in GATS agreements. The value of the RFE indicator for China and Chinese Taipei has been assessed following KS98 methodology. Restrictions on activities by foreign affiliates on domestic funding, retail operations, equity limits and new licenses for China and Chinese Taipei have been personally assessed in accordance to the respective WTO documents[3]. The OP variable has been built as the (log of the) product of a constant indicator (RFE) and trade openness in constant prices. RFE has been rescaled in the construction of OP as so that maximum restrictiveness (i.e. $RFE = 4$) lowers the impact of trade openness while minimium restrictiveness increases it.

[2]The policy commitments are listed in the WTO Members' Schedules of Specific Commitments made at the end of the Uruguay Round in December 1993 and the updates following the progress of global negotiations.

[3]See WTO (2002) for China and WTO (2001) for Chinese Taipei.

It might be argued that in constructing the OP variable RFE indicators have been associated with each economy's trade openness in years well before GATS agreements were actually signed by any of the sample countries and therefore OP cannot properly act as a dummy for financial openness.

Support for the use of OP throughout the sample length comes from at least three lines of argument.

First of all, KS98 argue that the nature of GATS commitments may make them more valuable than current policies, especially in emerging markets with a volatile policy record, as proxies for financial services trade policy restrictions as perceived by market participants.

Secondly, since the average country has been member of pro-openness institutions such as the IMF and the WTO for more than half and two thirds respectively of the standard sample period, it is argued that associating RFE to the whole length of the trade openness series might indeed be considered as a good proxy to the willingness of the country to liberalise the financial sector. Such hypothesis is also consistent with a follow-thy-client strategy by incumbent banks originating from states exporting in each sample country.

And finally Loayza and Ranciere (2002), choosing to constrain themselves to panel techniques, find slope dummies - built as the product of the financial development indicator and a crisis indicator running throughout the sample period - significative and particularly useful to tame the roller coaster behaviour of financial variables in crisis-hit countries.

As to the quality of all variables, as shown in tables A2-A6, most of them, with the exception of RR, are normally distributed and should grant quality estimates. Problems might be detected for some Latin American and African countries such as Argentina, Chile, Egypt, Ghana, Mexico, Senegal and South Africa (non normal KC and/or CR). For Chinese Taipei and Mexico a financially-closed economy specification of the model might give better results rather than a open economy one, given the detected non-normality in their OP variable. South African data, in addition to shorter series suffer from non normality with the exception of OP. Such bad quality does not bode well for the estimation exercise.

[Table 1: Some summary statistics here]

Summarising, the sample will be composed by 20 countries, all, with the exception of Korea and Mexico, non-OECD member. All of the countries are member of the WTO though, and apart from Chinese Taipei and Egypt all are subscribers to art. 8[4] the IMF statues. More specifically, the average country has been a member of the WTO, or its predecessor, for over 30 years and of the IMF for nearly 20.

[4]Article 8 sets forth the general obligations of each member with special reference to the avoidance of restrictions on current payments and of discriminatory currency practices and to the convertibility of foreign-held balance.

As a first assessment of the explanatory power of the main dependent variables within each sample country the main correlations in level and growth rates with CR are shown in table 2.

[Table 2a: CR Correlations and Table 2b: YC Correlations here]

Legend:
ΔX = annual growth rate of variable X
$\rho(X, Z)$ = correlation of variables X and Z over the sample period

Table 2a shows that the contemporaneous correlations between the level of real income, or real capital per capita, and financial development are positive with the exception of Costa Rica, Ghana, Mexico, Senegal and South Africa. Correlation with the levels of the capital income ratio is also positive but for Chile, Costa Rica, Ghana, Mexico and South Africa. Correlation with openness is positive with the exception of Costa Rica, Egypt, Mexico, Senegal and Venezuela. Both in the correlation with KY and OP minus signs prevail, although six countries show a positive sign. Correlation between CR and RR is, on average, lower than that with other endogenous variables and positive signs prevails and this support the interpretation of interest rates as a proxy for technical progress and therefore as input in financial development along capital, income and, possibly, openness.

In the correlation between CR and growth rates (i.e. ΔYC, ΔK, ΔOP and ΔKY), negative signs prevail in the first three cases, while correlation of CR and ΔOP shows a split with eight negative signs and ten positive ones. In the end a weak indication in favour of opposite sign relationships between financial development and real variables in the long vs. the short-term seem to emerge, while no precise pattern for the relationship of CR and with OP seems visible at this stage.

Table 2b shows the prevalence of positive signs in level correlation between YC and either KC, KY or OP. Partial exception are the African countries, except Morocco, and Chile and Venezuela. $\rho(YC, RR)$ is less clear-cut than that between CR and RR since positive and negative signs are equally split. In correlation between YC and growth rates of the variables negative signs prevail with the exception of ΔOP.

3.1 Stylised facts

Considering the World Bank income thresholds in real terms, to carry out intertemporal comparisons, table 1 shows that in 1961:

- 9 countries were considered Low Income (YC<US$745): China, Egypt, Ghana, India, Indonesia, Morocco, Philippines, Senegal and Thailand

- 9 countries were considered Lower Middle Income (US\$746$<YC<$US\$2975): Brazil, Chile, Chinese Taipei, Costa Rica, Koreal, Malaysia, Mexico, Singapore and South Africa
- 2 countries were considered Upper Middle Income (US\$2976$<YC<$US\$9205): Argentina and Venezuela
- No country reached High Income ($YC>$US\$9206).
- the KY ratio was not very dissimilar across income group being $1.7<KY<1.9$ while financial development was quite hetherogeneous being $14\%<CR<25\%$ with Lower Middle income countries showing the highest CR.

Forty-one years later some miracles and catastrophes have hit the universe of the sample countries. The main miracle is that only three countries, namely Ghana, India and Senegal, are below the US\$745 income poverty line in 2001. The same three countries, however, still show a CR similar to that of Lower Middle Income back in 1961! Also, 6 countries (4 Asian and 2 African) are now in the Lower Middle Income group, 8 in the Upper Middle Income Group (all of them South American with the exception of Malaysia and South Africa) and the 3 Asian Tigers are in the High Income Group.

Ghana represents the "economic development" catastrophe par excellence given that it is the only country with a negative average annual growth of KY in the whole sample. Senegal and Venezuela show a negative average annual growth of YC but in no country the misfunctioning of the economy seem to have gone so deep as to touch the accumulation process as in Ghana.

Mexico represents the "financial development" catastrophe as it is the only country where financial development is decreasing over the sample period.

End-of-period values of economic and financial development seem to be more closely clustered as CR and KY mostly grow with income. CR in Low Income countries does not go beyond 30%, while in Lower Middle Income countries starts at 36% except for Indonesia and in High Income countries starts above 100%! Higher Middle Income countries remain a bit of a problem in so far as their end-of-period CR remains low (starting from 11%) and also ends at 69% if it were not for the two non-Latin American countries in the group. Yet another clear evidence of the need of dummy variables for crisis-prone countries such as the Latin American ones.

KY pattern goes along the same lines with Low and Lower Middle Income countries in the $2.3<KY<3$ area. Higher Middle Income countries again show some problems since two countries, Chile and Costa Rica, have a lower KY than the best Lower Middle income and again the two non-Latin American countries in the group fare better than their peers.

High Income countries' KY starts at 2.6. At first sight it seems difficult to reconcile Chinese Taipei's reputation of (pre-1997) "Asian Tiger" and the lowest KY at the end of the period. The recent difficulties of Taiwanese banks[5],

[5]In August 2001 the Resolution Trust Commission was set up with a capital of TWD 14bn (euro 4.62 bn) to bail out all insolvent institutions. In May 2003 the government asked the

however, seem to give credit both to the importance of the KY indicator for "sound" financial development and the exceptionally of Taiwan among High Income countries.

3.2 The need of proper consideration for dummy variables

With the exception of China, Chinese Taipei, India and Singapore the average country in the sample has experienced more than 10 years of either banking crisis and/or some form of default in loans or bonds during the sample period[6]. Given that these shocks affects a subset of the variables (mainly CR and RR usually asymmetrically), and the effect will hardly disappear in the cointegration relation, dummies should be included for nearly all countries.

The heavy use of such ad hoc dummy variables is also justified by Loayza and Ranciere (2002) who find them essential in order to obtain results for countries subject to the effect of financial crisis longer than the average economic cycle. They observe that "in the case of private credit its correlation with growth is strongly negative prior to the crisis, and it becomes close to neutral in the aftermath". This effect is at odds with the long run nature of cointegration results and therefore needs proper consideration.

On the other hand, the usual practice to detect outlying observations from the estimated residuals in cointegrated VAR and to include unrestriced (innovational) dummies to whiten residuals, has no sound justification in theory.

More precisely, if there is a fixed number of outliers asymptotic distributions of estimates are unaffected and hence inference in the cointegration model is unchanged. But in finite samples distortionary effects could be relevant especially if outliers are not of the innovational but are additive instead. This should not wonder considering that the innovation specification of the estimation model is the fairly standard

$$\Delta Y_t = \alpha\beta' Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \alpha\beta' t + D_t + \mu_0 + \varepsilon_t \tag{3.1}$$

where Y_t is the vector of the endogenous variables in levels, k the lags (of the unrestricted, i.e. level, model), t the (eventual) time trend and D_t the dummy variable(s) while the additive specification of the estimation model is

$$\Delta Y_t = (\beta' : \beta_0' : \beta_1') \begin{pmatrix} Y_{t-1} \\ t \\ D_{t-1} \end{pmatrix} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \theta_i \Delta D_t + \sum_{i=0}^{k-1} \theta_i \Delta D_{t-i} + \mu_0 + \varepsilon_t \tag{3.2}$$

Parliament to increase the fund's budget allocation to TWD 540 bn (euro 17.5 bn) only to recapitalise insolvent banks. The latest proposal is still undergoing parliamentary debate. Source: Fitch Ratings (2003)

[6] see table 5

$$\text{subject to } \begin{cases} \beta_1 = \theta'\beta \\ \theta_i = -\Gamma_i\theta \quad \text{for } i = 1, ..., k-1 \end{cases}$$

where θ is the k-dimensional vector of parameters for the full lag structure of the dummy variables.

Please note that an additive impulse dummy eliminates the contribution from the observation to the likelihood function rather that the contribution from the residual.

In order to prevent a dangerously excessive use or deliberate misuse the objective detection and estimation procedure pioneered by Bohn Nielsen (2003) [BN03 from now] has been used.

4 Cointegration estimation

Before proceding with the estimation of the cointegrated VAR model[7] for each country, the stationarity of the series is checked with a (non reported) standard Augmented Dickey fuller test. Hence the following procedure has been followed:

1. Assume an order of cointegration and obtain lag length tests for the proposed VAR with no dummies;
2. Detect and estimate the type and the position of dummy variables with BN03 procedure;
3. Re-assess lag length and order of integration and proceed with identifying restrictions.

The first two steps are particularly crucial: on the one hand the lag, trend and order of cointegration are to be assumed and then held fixed for all the iterations needed for the outlier detection and estimation procedure and on the other hand these parameters - especially the lag length - may differ when the model is estimated with or without the dummies.

4.1 Lag choice

The lag, in no case higher than four in order not to limit degrees of freedom in the estimation of parameters excessively, has been chosen according to a hierarchy of criteria. First of all, as suggested by Johansen-Mosconi-Nielsen (2000), the Hannan-Quinn criterion has been tried, then lag suggested by other information tests, shown in the five coloumns on the left-hand section of table 3, are considered. If no meaningful result has been obtained this way, the lag showing better normality of residuals, as suggested by the last four coloumns

[7] All calculations have been conducted in EViews®. Codes for estimating the model can be obtained from the author.

of table 3, has been used instead. Evidence of the significance of the lag choice is offered by the (poor) results in the BN03 procedure applied to Indonesia, Singapore and South Africa where a more appealing interpretation of coefficients has suggested a lag choice alien to the one suggested by the tests.

[Table 3: Choice of the Lag Length here]

Table 3 shows for each country all the results of the lag length tests. For each country the first row of results represents tests calculated with no dummies and the second row tests calculated at the end of the BN03 procedure, as shown in tables 4.1-4.6. With the exception of Korea and Malaysia the inclusion of dummies always increases the preferred lag. In 5 cases the HQ-after-dummies has been the favoured choice and in 2 cases the HQ-before-dummies. A two-lag model has been the most frequent choice, being estimated for 12 countries. The use of four-lag model, particularly consuming in terms of degrees of freedom, has been limited to two countries and this is just one of the advantages of the BN03 procedure.

4.2 Outlier Detection & Estimation

The main steps of the iterative procedure can be outlined as follows:

1. Calculate residuals from Vector Error Correction Model (VECM) with lag order and cointegration rank assumed in table 3 with no dummy (VECM_0 from now on) and pick out data where residuals are higher than twice the standard deviation (i.e. outliers)
2. Calculate the VECM_0's statistic $t_0 = -\frac{n}{2} \lg |\Omega_0|$ where $|\Omega_0|$ is the determinant of the residuals' covariance matrix and n the number of observations
3. For the Innovation Outlier (IO) estimation insert an unrestricted dummy variable at the observed outlier's date ($_{year}$) and, using the same cointegration rank and alag order of VECM_0 calculate $t_{IO,year} = -\frac{n}{2} \lg |\Omega_{IO}|$
4. Obtain the likelihood ratio test $\tau_{IO,year} = -2 * (t_0 - t_{IO,year})$
5. Repeat for all the outlying observations and order the test results in descending order
6. For the Additive Outlier (AO) start assuming $\theta = 0$ and follow the iteration algorithm for Maximum Likelihood estimation in par 3.1 of BN03
7. Once covergence, say at at θ^*, is reached, obtain the likelihood estimation of (3.2) and the likelihood ratio test $\tau_{AO,year} = -2 * (t_0 - t_{AO,year})$
8. Repeat for all the outlying dates and order the test results in descending order

9. Insert a dummy at the observation where $\max_{year} \tau_i$ $i = AO, IO$ and estimate a VECM model (VECM_{dd})

10. Repeat the routine with VECM_{dd}=VECM_0 with the highest test value until no significant test values remain.

The value of the $\tau_{IO,year}$ and $\tau_{AO,year}$ tests for outliers in the single countries are shown in tables 4.1-4.6.

[Tables 4.1-4.6: Outlier Detection & Estimation here]

Iteration 0 is carried out on all observations with a standardised residual higher than 2, subsequent iterations pick the highest-test year (thick-bordered in the table) and insert a innovation or additive dummy in that year. The critical value, below which no further dummy is included in the model, is $\chi^2_{.9995}(5)$ and it is calculated focusing on the fact that the highest value statistics is chosen.

[Table 5: Dummy Variables and Crisis Patterns
and Graphs 1 & 2 here]

The rationale of the BN03 procedure can be assessed by comparing tables 4.1-4.6 with table 5 and graphs 1 & 2, where parsimoniousness of the dummies used in BN03 v. the years of crisis reported by the literature is striking. Table 5 and the graphs show that, according to different literature sources, the probability that in a random year in the sample period no country was in a crisis is 34%, that one country was in a crisis 12%. Also the "worst case scenario" would be to be one country in the sample in the years 1988 or 1989: then the probability that you would be in a crisis is, stunningly, 60%!!!! To name-and-shame Argentina and Indonesia, closely followed by Mexico, make it to the top of crisis-prone countries.

According to the BN03 approach, the might with which such financial quakes have hit the sample panel and the width of their effects come out much curtailed. Along with the results of the iterations, the probability that in a random year in the sample period no country was in a crisis is 22%, that one country was in a crisis 24%. The probability of crisis of 2 or 3 countries together is still double digit but dies down afterwards and abruptly stops at 7. In other words, crisis, as detected by the BN03 procedure, seem to be much less infectious than in the literature-source world. Also the "worst case scenario" would be to be one country in the sample in year 1974: then the probability that a randomly chosen country would be in a crisis is a less shattering 35%. This does not surprise when one considers that in the Seventies 17 countries had average negative real interest rates - a frequently-cited indicator of economic and/or financial difficulties of

some sort - comparing with 6 in the Sixties, 5 in the Eighties and 4 in the Nineties. In this new scenario Brazil and Ghana lead the crisis-prone countries hit list.

[Graph 3 here]

Please note that two notoriously crisis-prone countries with shorter times series available and a heavy lag structure, namely Indonesia and Mexico, have produced intelligible cointegration results thanks to the parsimonious BN03 procedure. Also the estimation of the CR series for China, specified in Appendix B, does not seem to have distorted the panel pattern, given that the outliers identified by the BN03 procedure are 1967-1970 and 1993 (the double-digit inflation and the FEC[8] unification with the renminbi).

4.3 Cointegration results

Table 6 shows the eignevalues and the cointegration test with two models with either i) intercepts in the cointegrating equations and no deterministic trends in the level data or ii) intercepts in the cointegrating equations and linear trends in the level data.

[Table 6: Eigenvalues and Cointegration Test here]

All countries support at least 2 cointegrating equations - financial depth relationship and output relationship from here on - at least at 1% confidence - according critical values from J.A. Doornik (1998) - with the except Malaysia.

The identification of parameters has proceeded imposing the following restrictions:

1. Normalisation: CR equation represents the link between financial development and economic development and YC equation represent the production function$\Rightarrow \beta_{1,1} = \beta_{2,1} = 1$
2. CR equation is linked to KY : $\beta_{1,2} = -\beta_{1,3}$
3. one of the cointegrating equation is not negatively influenced either by RR or by OP[9]

[8]The renminbi was massively overvalued in the 1980s and early 1990s, and a parallel currency, foreign-exchange certificates (FECs), circulated until 1994 to enable entities engaged in foreign trade to purchase foreign exchange at a more reasonable rate. The currencies were unified in 1994 and the renminbi pegged at Rmb 8.7:US$1. The average exchange rate in 1993 was Rmb 5.8:US$1.

[9]In practical terms this means testing one of the following restrictions a) $b_{1,4} = 0$, b) $b_{2,4} = 0$; c) interest rates is positively linked either with CR or YC i.e. $(b_{1,5} + b_{2,5}) = (b_{1,5_{unrestricted}} + b_{2,5_{unrestricted}})$ or $b_{1,5} = 0$ or $b_{2,5} = 0$ or $b_{i,5} = 0$ if $b_{\bar{i},5_{unrestricted}}$ where $i = 1, 2$ when $\bar{i} = 2, 1$ is near zero

Should the above restrictions give out equations that cannot be meaningfully interpreted the specification where capital does not enter the financial development equation,i.e. $\beta_{1,2} = 0$, has been estimated instead of nr.2.

[Table 7: Parameter Overidentifying Restrictions here]

The results in table 7 show for each country the specification, among those obtainable with the above restrictions and the identified dummies[10], with the highest $\chi^2(1)$ probability associated with the overidentifying restriction test. Chinese Taipei and South Africa, given the (poor) quality of the data already shown in A2-A6 tables, only manage to get restrictions significative at 1% level.

A few common elements seem to emerge. First of all, only in five cases, namely Brazil, China, Chinese Taipei, Costa Rica and Thailand the $\beta_{1,2} = 0$ model of financial intermediation is the preferred identification choice rather than the KY specification ($\beta_{1,2} = -\beta_{1,3}$). With the exception of Chinese Taipei, whose recent difficulties in the banking sector have already been mentioned, all these countries are concentrated in Lower or Upper Middle income group and Brazil and is also the heaviest dummy-laden countries. $|\beta_{1,2}|$ ranges seem roughly to increase with income with $0.1 < |\beta_{1,2}|_{Low} < 0.58$, $0.04 < |\beta_{1,2}|_{LowerMid} < 0.76$, and $0.09 < |\beta_{1,2}|_{UpperMid} < 0.98$, at least until the Upper Middle income level.

Secondly, there are six negative contributions of financial openness to financial development: two among "fairly liberal" countries (i.e. $RFE < 2$), namely Mexico and Morocco and four among "financially closed" countries, namely Brazil, Egypt, India and Venezuela. The two control countries, Costa Rica and Senegal, show a positive sign.

No High Income country, all of them with $RFE > 2$, show a negative contribution of openness to financial development and so do Low Income ones with the exception of India, which is however saddled with 5 crisis dummies. History of crisis for Brazil and Venezuela, and special trends in variables in Egypt (the only country in the sample with decreasing OP) rather than long-term relationship might be the reasons for $\beta_{1,4} < 0$. If,on the other hands, one considers caveats for the poor quality of estimations for South Africa, there is a weak evidence that "financial openness is bad for growth" especially in the Middle Income group with Morocco and Mexico supporting the evidence. The evaluation of China's RFE to 3, i.e. fairly restrictive, seems therefore to be justified, given the resulting positive contribution of financial openness to to financial development. Such assessment is less clear cut for Chinese Taipei, which suffers from already mentioned data and significance problems.

Thirdly, although table A6 unequivocally warns against the good quality of RR data, in terms of statistical properties such as normality, one cannot fail to

[10]Only in the case of Morocco and South Africa less dummies than those identified with the BN03 procedure have been used. IO at 1974 and 1986 have been used for Morocco and IO at 1974 and 1988 for South Africa.

observe that 12 out of 20 countries show a non negative $\beta_{1,5}$ and three countries show a $\beta_{1,5} < 0 \cap \beta_{2,5} < 0$. The only countries with $\beta_{1,5} > 0 \cap \beta_{2,5} > 0$ are China, Chinese Taipei and Korea, all considered "tigers" in terms of development with Egypt joining the group.

As far as the economic development cointegrating vector is concerned, "big" economies, i.e. Argentina, Brazil, China and India are the nearest one to the endogenous growth condition $\beta_{2,3} \to 1$. KC always gives a significative and positive contribution with the exception of Ghana, Morocco, Senegal and Venezuela. OP is nearly always significative and it is also positive with the exception of Brazil, India, Morocco, Senegal and Venezuela. Considering that Brazil and India are among the closest countries in the sample, with the trade/GDP ratio barely above 15%, Egypt[11] is the only African country able to escape the "African curse" whereby neither KC nor OP are able to account for development (or, rather, lack thereof). The fact that Chile shows a record of $\beta_{2,4} \approx 1$, might be due more to a compensation to the low $\beta_{2,3}$ than to a long-term feature itself.

Finally,the evidence on the contribution to the economic development equilibrium relationship by $\beta_{2,5}$ is quite clear-cut, with only Argentina, China, Chinese Taipei, Egypt, Korea and Venezuela showing a positive contribution from RR.

5 Concluding Remarks

The contribution that this paper aims to offer is a qualification of the link between financial and economic development with reference to restrictions to the role of financial openness.

Therefore, a link between economic and financial development has been tested for 20 sample countries especially selected from a set of financially open economies underwriters of the GATS protocol of the WTO. Financial openness has been proxied by the product of trade openness times an inverse function of the restrictiveness of foreign establishment indicator.

For China and Chinese Taipei, being the newest WTO members, the foreign restrictiveness indicator has been assessed from their own protocol of admission to the WTO. For China the financial development indicator, i.e. the credit/GDP ratio for years 1961-1976 has also been estimated from data on growth rate of loans to enterprises stated in the relevant five-year plans.

Furthermore, in order to come to terms with crisis periods in the time series a special detection and estimation procedure has been used to place dummies. This procedure has proved extremely conducive to results insofar as it is parsimonious in terms of degrees of freedom and quite precise, as exemplified by the interpretation of the case of China.

[11] with South Africa, whose bad quality of data and estimation results have already been mentioned

In line with the literature reviewed, the results of this paper seem to confim a non linear relationship between financial development and accumulation i.e. $|\beta_{1,2}|$ values seem to increase with income at least until Upper Middle Income group. Non-linearity seems to be characterising financial development too. The KY specification of the financial development cointegrating equation is preferred in all but five cases, namely Brazil, China, Chinese Taipei, Costa Rica and Thailand. With the exception of Chinese Taipei (banking difficulties) all these countries are concentrated in Lower or Upper Middle income group and Brazil is also the heaviest dummy-laden countries.

There is also weak evidence for financial openness being bad for growth as shown by $\beta_{1,4} < 0$ in Morocco and Mexico. Exceptions suffer from poor quality either of estimation (South Africa) or of data (Ghana). Argentina also shows a positive correlation but with a very low value. No High Income country, all of them financially closed (i.e. RFE>2), show a negative contribution of openness to financial development and so do Low Income ones with the exception of India, which is however saddled with 5 crisis dummies. Financially closed Brazil and Venezuela and Egypt have $\beta_{1,4} < 0$ but the former two are heavy with crises dummies and Egypt is the only country in the sample with decreasing OP.

In line with Aretsis-Demetriades-Fattouh-Mouratidis (2002) the model finds positive effect of real interest rate on financial development for most countries.

Finally, as far as the economic development is concerned "big" economies, i.e. Argentina, Brazil, China and India are the nearest ones to the endogenous growth condition $\beta_{2,3} \longrightarrow 1$. KC nearly always gives a significative and positive contribution to economic development and so does OP except in Ghana, Morocco and Senegal. Egypt and South Africa, are hence the only African countries able to escape the "African curse" whereby neither KC nor OP are able to account for development (or, rather, lack thereof).

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A Data Desciption

TABLE A1: VARIABLES AND SOURCES[12]

VARIABLE	DESCRIPTION	SOURCE
CR	Credit to private sector/GDP	WDI03[13]
YC	Real income per capita in 1995 US$	Ratio of real income to population from WDI03[14]
KC	Real capital stock per capita in 1995 US$	Calculated from real investment data from WDI03[15]
OP	Composite financial openness indicator = openness*rescaled RFE	
	openness in constant prices = (import+export)/GDP	WDI03[16]
	rescaled RFE[17]	KS98
RR	Real interest rate = Discount rate - annual inflation	
	Discount rate	IFS[18]
	Annual inflation	WDI03[19]
KY	Capital-income ratio	KC/YC

[12]I would like to thank the Central Bank of China, Nicholas Kwan (HKMA) and Cesar M.Calderon (Central Bank of Chile) for their help in providing data.

[13]**Chinese Taipei**: Central Bank of China. **China** 1961-1977: see Appendix B

[14]**Chinese Taipei** 1961-98: PWT6.1, 1999-01 calculated with growth rate from nominal income per capita from Directorate-General of Budget, Accounting and Statistics, Monthly Statistics, Taiwan District, Republic of China [TW-MonStat]

[15]calculated with Easterly - Levine (2001) perpetual inventory formula.

[16]Taiwan: 1999-2001 Rescaled [Imp(line98c)+exp(90c)]/gdp(99b) from [TW-MonStat]

[17]Rescaled RFE =[1+(6-original RFE)/5]; Rescaled RFE =1 if original RFE not ranked; Rescaled RFE =2.2 if original RFE = 0 [minimum restrictions]; Rescaled RFE =1.4 if original RFE = 4 [maximum restriction]

[18]**Argentina**: 1961-1967 and 1974-1976: Tasas de interes vencidas abonadas por depositos a plazo fijio, en bancos diciembre; 1968-1973: Tasas de interes abonadas a los investitores en el mercato de aceptaciones diciembre from Memoria Anual - Banco Central de la Republica Argentina, various years. **Brazil**: money market rate. **Chile**: interest on short run loans from Cesar Calderon Banco Central de Chile. **China**: 1961-1978 annual rate on demand deposit as calculated from monthly interest rate from table 10 pag 154 of W. A. Byrd (1983). **Chinese Taipei**: Rediscount rate from the Central Bank of China. **Korea** 1961-66: real interest rate from Luintel-Khan (1999). **Indonesia** 1965-1969: Lowest regulated interest rate for credit from the Report of Bank Indonesia, various years. **Singapore** 1961-72: Malaysia's money market rate. **Mexico** 1965-1976: Annual interest rate of Bonos hipotecarios ordinarios in December from: Indicatores Economicos - Banco de Mexico, various years; 1977 onwards deposit rate WDI03. **Thailand** 1961-76: real interest rate from Luintel-Khan (1999).

[19]**Brazil**: annual percentage growth of the FGV Index from Banco Central do Brazil. **China** 1961-1969: regression with the rate of growth of the Gross Value Added in Industry

[Tables A2-A6 here]

B Domestic Credit on GDP ($CHCR$) for China in 1961-1976[20]

Domestic credit for China in the period 1961-1976 has been calculated applying the average yearly growth rate of loans to enterprises from table 2 page 138 (gr) of W. Byrd (1983) to:

1. initial working capital loans in 1957 ($L57$) as estimated on page 125 of K. Hsiao (1971) + Investment in Fixed assets funded by domestic loans (FX) of coloumn 3 of table on page 25 of Department of Statistics on Investment in Fixed Assets National Bureau of Statistics of China (2002) and to

2. the level of bank loans in 1980 by table 2 page 27 K. Hsiao (1984).

So the final formula sums the (forward) smoothed working capital loans from 1957 and the (backward) smoothed bank loans from 1980

$CHCR_{year} = [f_{year} + h_{year}] / (2 * \text{no min al} GDP_{year})$

where

$f_{year} = gr\,(L57)_{year} + FX_{year}$

$h_{year} = gr^{-1}\,(L80)_{year}$

in Table B.3. of Maddison (1998) as independent variable. **Ghana** 1961-64: calculated from a regression of the difference of real and nominal GDP growth rates from WDI03.

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