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Growth, capital flows and enforcement constraints*

The case of Africa

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1. Introduction

The alternative financing opportunities available to a country or a region can be an important factor in explaining growth rate differentials and patterns of international capital flows. In this paper we focus on the effects that alternative incentive constraints can have in determining a country's financial opportunities and its process of capital accumulation. More specifically, we study the empirical implications of the theoretical model developed in Marimon (1988) and Marcet and Marimon (1992) (M&M, hereafter). To this aim, we analyze the case of African countries in the period 1975–1987.

In the M&M model a country, which is small with respect to the international financial markets, is endowed with a stochastic neoclassical growth technology. The country, facing idiosyncratic shocks, can use outside financing to smooth its consumption. In addition, if it has a low initial capital stock, it can accelerate its growth towards the steady state by borrowing from abroad. This is the classical prescription of the neoclassical growth model with decreasing returns: *capital should flow from rich to poor countries*. While we do observe transfers to LDC (Less Developed Countries),

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the flow of capital is by no means of the size predicted by the standard model [see, for example, Lucas (1990)]. This can be seen, for example, by looking at data from African countries. The M&M model, however, not only considers the standard scenarios of *autarky* and *integration to perfect capital markets*, but also intermediate scenarios where a country's ability to borrow may be partially limited by the fact that outside lenders can only *imperfectly monitor investments and enforce contracts*. These *constrained* economies display patterns of capital flows and investment different from the unconstrained case described before. In particular, using simulations, we have shown that the potential growth gains from having access to outside financing can be washed out by the risk of debt repudiation. This does not mean, however, that the country has to revert to autarky from the first period, as a process of backwards induction in a deterministic model would predict. Outside financing can still play an important role in smoothing consumption and, therefore, there are still welfare gains from opening the country to the international capital markets. While our empirical application is on Africa, these issues also affect other LDC and economies in transition as the Eastern European countries.

We do not claim that alternative financing opportunities are the only, or main, missing factor in the neoclassical growth model, but a complementary factor that can help explain growth rate differentials and some observed asymmetries between growth of countries and regions and between international and domestic flows. For example, an endogenous growth model of *learning by doing* [see, for example, Stokey (1991) and Young (1991)], or of some other factor having an external effect, has similar implications about growth differentials between LDC and DC (Developed Countries), as for growth differentials between poor and rich regions among DC. Nevertheless, we do observe higher convergence among regions within DC than between countries in a worldwide scale [Barro (1991), Barro and Sala-i-Martin (1991)]. A similar point can be made about models with *poverty traps* [see, for example, Azariadis and Drazen (1990)], why should poverty traps be so pervasive for some LDC and not for some relatively underdeveloped regions? For example, some relatively underdeveloped regions have *taken off* using technologies that do not require a high stock of knowledge, why don't we observe similar technologies at work in underdeveloped countries? In the M&M model there are different predictions about the process of capital accumulation and the distribution of growth for different contractual environments. Since enforcement constraints can be more or less binding depending on whether the borrower is a less developed country or a region in a developed country, the model does not provide the same prediction about rates of economic convergence.

In this paper, we look at the empirical implications of the effect of incentive constraints on growth and the distribution of wealth. We use the

following approach. First, we characterize the testable implications of the M&M model regarding movements and comovements of output, consumption, investment and capital flows for the different environments under study. Second, we use a country's data to see whether a country can be classified according to our taxonomy. Of course, reputation and observability are questions of degree, therefore we classify countries according to whether they are relatively more or less unconstrained. Third, once countries have been classified, we test whether we detect growth differentials among groups as the theoretical model predicts.

We have analyzed the case of Africa where most countries will fit the description of being small with respect to the international capital markets and have a low initial capital stock. The choice of African countries, however, creates some problems: the availability of data is limited (we use World Bank annual data for the period 1975–1987) and, more importantly, even if initial capitals where low, the GDP per capita of all the countries taken as a group (South Africa and a few more countries excluded) grows in the subperiod 1975–1980 but falls for the remaining of the period, ending with a even lower GDP per capita. In the theoretical model, these movements should only happen at the steady state, but at the steady state the current formulation of the model does not allow us to discriminate between constrained and unconstrained countries, which is our concern here. In our sample many countries display a positive correlation between GDP and capital flows. This is not consistent with the model predictions on consumption smoothing and, therefore, these countries cannot be classified as unconstrained or (previously) constrained. However, their level of capital flows is substantial enough so that they cannot be considered in autarky; these countries cannot be classified within our taxonomy. Nevertheless, for the countries that are classified, growth rate differentials support the M&M model: constrained countries have growth rates which are very close to those of autarky and the growth rate differential between unconstrained and constrained countries – of the order of 1% in our simulations – is of the order of 2% for the countries under study.

2. The model and its empirical imlications

Let us summarize the model of capital accumulation with incentive constraints described in M&M. The utility of the representative agent of a country is given by $E_0\sum_{t=0}^{\infty}\delta^t u(c_t)$, where $\{c_t\}_{t=0}^{\infty}$ is the consumption stream, and δ the discount factor. The rest of the world is represented by a risk-neutral agent with the same discounting as above setting $u(c)=c$. This specification captures a situation where the rest of the world is very large compared with the country that we are studying. A country can engage in

borrowing and lending activities with the rest of the world. These activities are summarized in the capital flow that this country receives, represented by $\{\tau_t\}$; when τ_t is positive it means that the country is a net borrower, while interest payments and loan re-payments contribute negatively to τ_t.

Each period this country produces $f(k_t)$ units of output, and it decides how much to consume and invest according to the equality $c_t + i_t = f(k_t) + \tau_t$, and the law of motion for capital $k_{t+1} = dk_t + g(i_t, \theta_{t+1})$. Investment contributes to the production of new capital units, and this contribution is affected by the vector of exogenous stochastic productivity shocks $\{\theta_t\}$. We introduce the productivity shocks in the transition function of capital in order to prevent the rest of the world to infer the level of investment from observations on the capital stock. The model has a steady state and, it can generate growth during the transition from an initially low capital stock.

The optimal allocations in the model are analyzed under four regimes: (i) financial autarky (AU), where $\tau_t = 0$; (ii) full information and full commitment, where all contracts are honored and all the information is revealed to the rest of the world, so that the allocations are chosen according to the unrestricted Pareto Optimum (PO); (iii) partial information (PI) and full commitment, where the rest of the world does not observe all shocks to productivity; and (iv) full information with partial commitment (PC), where the rest of the world observes all the shocks but it is possible for the country to default on its debt and switch to autarky if the value of staying in the world capital market falls below the value under autarky. In regime (iv), enforceable contracts satisfying the participation constraint $E_t \sum_{t=0}^{\infty} \delta^t u(c_{t+t}) \geqq V^a(k_t, \theta_t)$ for all t (here V^a is the value function under autarky).

With functional forms and parameter values chosen according to the standards of modern real business cycle theory, the optimal allocations can be characterized by simulation. These allocations present the following features: (i) growth under autarky is as slow, or somewhat slower, as with partial commitment; (ii) growth under partial information and the full Pareto optimum is the same, and it is much higher than under the previous two regimes; (iii) capital flows under the full Pareto optimum are used for investment, so the level of capital flows is very high when the country is growing; at the steady state the level of these flows is small, and they are used to insure the country, so they are negatively correlated with output; (iv) capital flows under partial information are less negatively correlated with output than in the previous regime, because the incentive constraints call for punishing the country when it does not perform well; (v) capital flows under partial commitment in the growth period are not correlated with the *level* of output, but they are negatively correlated with *deviations* of output from its trend; this is because borrowing can be used to smooth consumption against unforeseen shocks, but not for investment purposes; the level of capital flows is small, of the order of 1% of GDP on average, and this level is independent

Table 1

Correlations implied by the model.[a]

Variables	Growth or no growth	Full commit full comunic	Partial commit full comunic	Autarky
Cpt. flow–GDP	Growth	−1	0	0
Cpt. flow–dev GDP	Growth	0	−0.5	0
Cpt flow–GDP	No-growth	−0.5	−0.5	0
Cpt. flow–dev GDP	No-growth	0.08	0.08	0
Dev. cons.–dev GDP	Growth	0	0.7	0.88
Dev cons.–cpt flow	Growth	0	0.05	0
Cons.–GDP	No-growth	0	0	0.97
Cpt flow–inv	No-growth	−0.17	−0.17	0

[a]The correlations that appear as exact zeroes or minus ones represent correlations whose values are evident from simple observation of the simulation. The actual numbers are very close, but not exactly equal to, zero or minus one. (Cpt stands for capital; cons for consumption, inv for investment, and dev for deviations from the trend.) Both for the real data and for the model we use the following trend: $\log(y_{t+1} - y_t) = a - b\log(y_t) + \varepsilon_{t+1}$.

of whether the country is growing or is at the steady state. The intuition for this latter result is the following: if a country wants to borrow because it just had a negative shock, the value of autarky decreases, so there is no immediate danger of the country defaulting; however, if the country wants to borrow for investment, this raises the capital stock in the next few periods, it raises the value of autarky and the danger of defaulting.

We do not want to use testable implications that are highly dependent on parameter values or initial conditions. In particular, the growth *levels* (3% and 4% in M&M) depend highly on the initial conditions for capital. But we would expect to find that, on average, countries characterized as being in the full optimum or under private information have larger growth rates than countries with partial enforcement or autarky.

Table 1 contains some of the correlations of interest implied by the model. Each realization of deviations is calculated using the estimate of the trend parameters a and b with past data from that realization. These correlations were calculated using independent realizations of the shocks and the numerical procedures described in M&M. The growth period is taken as 20 years of growth towards the steady state, while no-growth is represented by the distribution at the steady state.

3. The case of Africa

We use the World Bank data on African countries [World Bank (1992)].

Table 2

Correlations for African countries.[a]

Country number	Growth 75–87	Cpt. flow GDP	Cpt flow dev GDP	Cpt. flow dev. cons.	Cpt flow inv	dev. GDP dev. cons
1.0000	0.0188	−0.6057	−0.0289	−0 4476	−0.0420	0.7224
12 0000	0.0034	0.2798	0.6350	0.5292	0.7657	0.7382
15.0000	0.0768	0.3207	0.5139	0 4602	0.2206	0.6546
18.0000	0.0246	−0.0687	0 1561	0.4004	−0.6217	0.0428
19.0000	0.0146	0.4309	−0.0100	−0 0053	0.8101	0.9995
20.0000	0.0508	−0.6528	0.0365	−0 2924	−0 4324	0 6357
23 0000	−0.0110	−0.4678	−0.3289	−0.3283	−0.0665	0.9992
24.0000	−0.0137	0.5531	0.3840	−0 3076	0.6148	−0.1611
29 0000	0 0336	0 0009	−0.0070	0.2311	0.1926	0 4378
31.0000	−0.0161	0.6987	0.3650	0 2929	0 8457	0.8565
39.0000	0.0476	−0.7301	0.2406	−0.1290	−0.0982	0.3514
42.0000	0.0049	0.3937	0.2764	0 0987	−0.1229	0.6797
46.0000	−0 0519	0.4484	0 4632	−0.1807	0.4630	0.6648
49.0000	−0.0152	0.0461	0.7643	0.6016	0.0035	0.8525
69 0000	0.0038	0.3490	0.0320	0 0370	0.7461	0 9998
74,0000	−0.0297	0.4619	0.6209	0.3227	0 3086	0.5267
77.0000	−0.0268	0.2189	0.1692	0.1562	0.6471	0 9996
78.0000	−0 0013	0.7295	0.2781	0.5126	0.7384	0.7632
80.0000	0.0221	0 5199	0.5751	0 4698	0 4647	0 7211
82.0000	−0.0026	0.3140	−0 0934	−0.4000	0.3446	−0.3907
83.0000	0.0372	−0.4418	0.1291	0 1598	0.1668	0 7023
86.0000	0.0154	−0 5817	0.1864	0.3430	0.8546	0.4399
93.0000	−0.0115	0.6766	0.0135	0 2177	0.6094	−0.0738
94 0000	−0.0255	0.4660	0 3216	0.3834	0.4045	0.6801
106.0000	0.0117	0.3432	0.1155	−0 3811	0 6936	0 0726
107 0000	−0.0003	0.1965	−0 2624	0.0686	0.4980	0.7044
112.0000	−0.0035	−0.2041	−0.1690	−0.0296	−0 1999	0.9468
114 0000	−0.0171	0 5900	−0.0955	0.0735	0.4090	0.1927
117.0000	0.0086	0.0355	−0.1440	−0.3885	−0.3702	0.6839
121.0000	−0.0108	0 4267	−0 0090	0.0811	0.2325	0.9772
123 0000	−0.0079	0 5997	0.7628	NaN	0.8930	NaN
127.0000	−0.0147	0.2088	0.0380	0.0993	0.3016	−0.2533
129.0000	−0.0123	0.6501	0.1670	0.2209	0.9268	0 6433
132 0000	0.0223	−0 7742	0.3091	0.2780	0.4439	0.9446
134.0000	−0.0378	0.1320	0.3082	0 2372	0.6022	0.7837
144.0000	−0 0278	0.8678	0 0239	0 1450	−0.2591	0.5844
145.0000	−0.0292	0 2906	−0.1967	0 1929	0.4989	0.5248
146.0000	−0.0116	0.2722	0 1452	−0.0785	0.0782	0.4122

[a]Country numbers correspond to their World Bank's (1992) numbers in the World Tables

Since for some countries the relevant available data is incomplete, our sample only includes 38 out of the 51 African countries. We have transformed all the variables to have per capita constant dollar value, and we have computed capital flows as the difference between disbursements from commitments of long-term external loans and principal and interest payments. Table 2 shows the time series correlations for these countries and their corresponding yearly growth rate for the period 1975–1987. Countries

are selected according to the criteria discussed in section 2 and also according to the importance of outside capital flows.[1]

As it can be seen in table 2 a large number of countries experience almost zero or negative growth rates over the period under study. According to table 1, for these countries the model does not discriminate between constrained and unconstrained regimes, since they both have the same steady state. However, most of these countries have a positive correlation between capital flows and GDP, but cannot qualify as being in autarky since capital flows are non-negligible. As a result, we are only able to classify a small number of countries. Among countries that experience growth in the period 1975–1987 four are selected as *unconstrained* [Algeria (1), Cameroon (20), Mauritius (83) and Morocco (86)] and only one satisfies all criteria for the model with enforcement contraints [Somalia (117)]. The average growth rate for the unconstrained group is 3.06%, while the growth rate for Somalia is 0.86%. This supports the model, but the sample size is too small as to make any final statement. Among the countries that do not experience growth, two are selected as either *unconstrained or (previously) constrained* [Central African Rep. (23) and Senegal (112)], and only one as *autarky* [Ghana (49)]. We have also carried out a weaker set of tests which has resulted in larger groups, and the differences in growth rates between unconstrained and constrained countries have remained significant.

4. Conclusions

This paper represents a first attempt to compare the M&M model with the data. A broader selection of countries, in particular a selection including more countries with positive growth rates can provide a better test of the growth rate differentials implied by the model. Individual country analysis suggests that incentive constraints may have been underestimated by our tests. For example, information constraints do not change the nature of the correlations in our model since they only reduce the negative correlation between capital flows and GDP, but this is in part due to the fact that in our model there is no delay in the monitoring technology. Investments are not observed, but current capital determining current output is observed. Intro-

[1]A country is considered to grow if its growth rate 1975-1987 is at least 0.005; to have a negative correlation between capital flows and GDP if this correlation is at most −0.2; to have a low correlation between capital flows and deviations of GDP if this correlation is at most 0.2 in absolute value. A country satisfying these criteria is labeled *unconstrained*. A country that grows, has low correlation between capital flows and GDP (less than 0.2 in abs. value) and negative correlation between capital flows and deviations of GDP, is labeled *constrained*. A country is also labeled either unconstrained or constrained if it does not grow and has a negative correlation between capital flows and GDP. A country that does not satisfy these tests and has an average ratio of transfers (in absolute value) to GDP of less than 0.01 is labeled *autarchic*, and the remaining countries remain unclassified.

ducing lags between productivity shocks and optimal punishments and rewards may change some of the correlation tests, which in turn may result in some unclassified countries being classified as having information, and possibly enforcement, constraints.

Two more final points are in order. First, that in our model a country's capital flow does not affect the world risk-free interest rate, a more developed model should allow for the general equilibrium effects of different countries borrowing and lending. Second, a more sophisticated treatment of the underlying technology, e.g., introducing human capital, may allow for steady states which are not the terminal distribution of an unconstrained country.

This study shows a way to empirically test growth models, accounting for the interaction between capital flows and growth, and the effects of enforcement or information constraints.

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