

Exits from the Poverty Trap and Growth Accelerations in a Dual Economy Model

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Abstract

We propose a simple theoretical dual economy model to study the dynamics of an economy in which individuals move out of a poverty trap. These dynamics are characterized by growth acceleration. This model implies that poverty reduction could, under some circumstances, cause growth, rather than the other way around. We define a measurement of the growth impulse that could be triggered by independent exits from poverty and correlate it with observed growth accelerations. This correlation is both positive and significant, and it passes various robustness checks.

JEL Classification: O11, I32, D31

Keywords: Growth acceleration; poverty trap; poverty reduction.

I. Introduction

Since the seminal paper of Lewis (1954), dualism has been a major subject in development economics. Gollin (2014) provides a good recent review of the post-Lewis literature on dualism. A central theme in this literature is understanding either the extent to which dualism, which is commonly observed in developing countries, disappears naturally over time, as expected by Lewis, or whether it persists indefinitely.

The notion of the poverty trap provides a useful framework to study both the possible persistence of dualism and the dynamics leading to the escape from dualism. We propose to link this notion to the analysis of dualism by assuming that those in the traditional sector are trapped in poverty, whereas those in the modern sector are not; in this sense, escaping the poverty trap is associated with moving from the traditional sector to the modern sector.

The relevance for development economics of the notion of the poverty trap has been the subject of some debate. Kraay and McKenzie (2014) conclude, from observation of numerous recent accelerations in developing countries, that the empirical relevance of this notion is limited. However, in this paper, we suggest that growth accelerations may, in some cases, correspond to exits from poverty traps.

Exits from poverty traps have rarely been studied as such, and understanding how such exits can occur would be essential in giving relevance to the notion of the poverty trap from a policy point of view. This paper intends to contribute to filling this gap. Fiaschi and Lavazzi (2003) analyzed growth accelerations in non-linear Solovian aggregate growth models with multiple equilibriums. However, Kraay and Radatz (2007) have cast doubt on the empirical relevance of poverty trap models based on modified Solovian models. Here, we propose a different modeling approach, based on a micro-founded model of exits from the poverty trap, in which poverty exits, when they occur, lead to growth acceleration.

Hausmann et al. (2005) admitted that escapes from the poverty trap might be, at the aggregate level, responsible for some of the observed growth accelerations. However, these researchers did not follow this route, as they considered that accelerations are merely the result of changes in long-run steady states associated with either reforms, external shocks, or political shocks.

Although Hausmann et al. (2005) found significant estimates that are consistent with their hypothesized mechanisms, the marginal effects of their explanatory variables on the probability of growth acceleration are very small, leaving acceleration episodes mostly unexplained. Our contribution aims at studying the extent to which exits from poverty traps may offer an additional explanation of acceleration episodes.

In addition to contributing to the analysis of growth acceleration episodes, our theoretical framework provides an alternative approach to the typical discussion of the growth-inequality-poverty nexus. The mainstream literature considers the extent to which poverty reduction is a

consequence of economic growth, which is possibly mitigated by supposedly exogenous changes in income distribution (see, e.g., Ravallion, 2001, and Bourguignon, 2004). Conversely, our model puts poverty reduction at the start of the chain of causations: poverty trap exits may create a distinct acceleration of growth, as opposed to being a mere consequence of income growth.

This paper is organized as follows. Section 2 offers a brief review of the related literature, which provides micro-foundations for poverty trap models. In section 3, we propose a specific theoretical formulation in which poverty exits are analyzed as migration from the traditional sector to the modern sector. Section 4 proposes a methodology to correlate poverty exit events with growth accelerations. Section 5 provides empirical results, which complement the growth acceleration analysis established by Hausmann et al. (2005). Section 6 discusses these results, and section 7 concludes.

II. Literature review

Our starting point is Azariadis and Stachurski's (2004) definition of a poverty trap as "any self-reinforcing mechanism which causes poverty to persist". This notion of the poverty trap has been explored both theoretically and empirically. Some papers consider both single-equilibrium and multiple-equilibrium poverty traps. As we are ultimately interested in transitions out of the poverty trap—poverty exits—we consider only poverty traps in a framework involving multiple equilibriums.

The term poverty trap is used at different levels of aggregation, from the individual, or household, microeconomic level to the macroeconomic, or countrywide, level. Mechanisms underlying poverty traps at different levels of aggregation are similar, as suggested by Barrett and Swallow (2006). We refer interested readers to recent surveys of this literature in Barrett and Carter (2013), who consider mainly microeconomic aspects, and in Kraay and McKenzie (2014), who also discuss the available evidence at the aggregate level. In what follows, we consider only the microeconomic foundations of poverty traps.

Most microeconomic models of the poverty trap rely on particular, non-convex, assumptions regarding technology that are complemented by capital market imperfections. A precursor to such models was Galor and Zeira (1993), who showed, in an overlapping generation growth model with multiple equilibriums, that the long-run steady state of the economy depends on initial income distribution. The central assumption is that individuals face indivisible costs of investment in educating the next generation, which they cannot finance through borrowing. The final outcome depends on how many dynasties can invest in education, which is principally determined by initial income distribution. Similarly, in the so-called asset-based poverty trap model (Carter and Barret, 2006), individuals choose between traditional subsistence activities and modern entrepreneurial activities that require a fixed indivisible investment. Moving out of the poverty trap would imply investing in relatively expensive modern tools of production; this is prevented by risk-aversion and imperfections in the capital market.

In Moav and Neeman (2010), the indivisible fixed cost conditioning poverty exit is related to conspicuous consumption as a means of improving social status, which, in turn, has a positive impact on the individual's utility function. In their model, conspicuous consumption may maintain individuals in chronic poverty, as it is considered as being a sort of unproductive expenditure, but the existence of multiple equilibriums results again from the indivisibility assumption, made this time on conspicuous consumption, which introduces the same kind of non-convexity as in previous models.

Although these theoretical models of poverty traps have attracted substantial attention in theoretical literature, a consensus has hardly been reached regarding their empirical relevance. Kraay and McKenzie (2014) argue that indivisible investment that would be necessary to create a modern activity can barely be observed. The evidence of poor developmental impact of access to microfinance, as found by Banerjee et al. (2015), also questions the empirical validity of the asset-based poverty trap approach, as it suggests that better access to finance does not lift individuals out of the poverty trap. However, more recent evidence of sizable multiplier effects of cash transfer programs (Handa et al., 2018) and/or of the provision of micro-insurance (Jensen et al., 2017), suggest that the credit constraints may be, nevertheless, a relevant obstacle to poverty exits.

Kraay and McKenzie (2014) also admit that poverty trap mechanisms could be observed in so-called geographic-poverty traps (Jallan and Ravallion, 2002), where individuals are locked in unfavorable locations that they cannot escape from. In the Chinese context, analyzed by Jallan and Ravallion (2002), the obstacles to migration are related to administrative constraints (the so-called Hukou system). But escaping the geographic poverty trap could also be prevented both by high costs attached to the migration process and by the uncertainties of its outcome. This goes beyond the mere physical migration costs. Moving from a low-paid job to a better job involves significant job search costs, even for individuals already living in a city, as suggested by Abebe et al. (2016), who found that the medium job search cost of active job seekers in Addis Ababa represents 16% of their total expenditure. Abebe et al. (2016) also found, using a randomized control trial experiment, that subsidizing job searching is an effective policy intervention to lift individuals out of poverty.

In summary, the previous literature provides foundations for poverty trap models, which may be developed in many different directions. Some of these models may, admittedly, be less relevant than are others from an empirical point of view, but they all rest on the same mechanisms, involving a non-convexity related to the fixed costs associated with attempts to escape poverty, in a context of capital market imperfections.

To be complete, we mention a relatively new approach of poverty traps initiated by Becker and Mulligan (1997), based on so-called behavioral poverty traps. In Laajaj (2017), poverty reduces the time horizon of individuals. Hence, there is no need of capital market imperfection to obtain multiple equilibriums, because the inter-temporal rationality of poor individuals is bounded by their poverty. Although it is certainly interesting and nicely complements the non-convexity assumptions underlying previous models of poverty traps, we do not follow this route here. As will become clear in the next section, our result of growth accelerations in relation with poverty exits relies on the

combination of a threshold effect and some kinds of social interactions, which influence the way in which poor individuals overcome the threshold barrier to exiting poverty. Hence, we choose to simplify, as much as possible, the source of threshold effects and concentrate on the dynamics associated with social interactions.

In the next section, we build a simple model of poverty exit in which the exit from poverty results from a migration, from the traditional to the modern sector, which involves overcoming a fixed cost of migration barrier but also involves collecting information on the likelihood of a positive outcome of this migration.

III. A simple theoretical model of poverty exits and growth acceleration

Let us consider a population consisting of a proportion $1-h$ of poor individuals locked in low-productivity jobs and a proportion h of individuals who have escaped this low equilibrium and who enjoy higher-productivity jobs. We abstract from demographic factors and concentrate our attention on the structure of this population. The overall structure corresponds to a typical dual economy model. Dualism has disappeared when all individuals have escaped the low equilibrium and have high-productivity jobs. Low-productivity jobs are typically associated with traditional modes of production, whereas high-productivity jobs correspond to modern modes of production.

The average incomes of the low-productivity and high-productivity individuals are y_L and y_H , respectively. Hence, the average income of the population is given by:

$$y(t) = h(t)y_H + (1 - h(t))y_L = y_L + (y_H - y_L)h(t) \quad (1)$$

Incomes can deviate at each point of time from these averages due to independently-distributed temporary shocks. As a result of these shocks, individuals with low-productivity jobs can move to high-productivity jobs under certain circumstances. As a simplifying assumption, we assume for a while that shocks incurred by individuals in high-productivity jobs never pull the individuals down to low-productivity status, and we will relax this assumption later on.

We illustrate the movements from low-productivity jobs to high-productivity jobs as a migration process. We assume that escaping the low-productivity jobs involves a sunk cost, related to physical migration and/or job search costs. This sunk cost can be assumed only by individuals whose income is above a threshold level, called θ , with $\theta > y_L$. The parameter θ separates individuals who are chronically poor from those who are non-chronically poor; henceforth, we call this parameter the poverty line.

We assume that it is not possible to borrow to pay this cost, due to imperfections in the capital market. In our framework, this borrowing constraint is natural, given that moral hazard issues faced by lenders are amplified when borrowers migrate and then escape the reach of their lenders. Hence, shifting from low equilibrium to high equilibrium depends on a positive individual shock (push factor).

We call F the cumulative distribution function of shocks that affect individuals at each point of time. The proportion π of individuals in the total population who are initially poor but can cover the sunk cost of migration is:

$$\pi = (1 - h)(1 - F(\theta - y_L)) \quad (2)$$

We call them prospective migrants. As in standard migration models, the decision to migrate depends not only on the ability to pay the sunk costs of migration but also on the expectation by the prospective migrant that his income will be better at the place of destination than at the place of origin. Therefore, the decision depends on the expectations of the prospective migrant of his likelihood of getting a job in the modern sector after migration (pull factor). We assume that the proportion of prospective migrants who expect to get a job in the modern sector, and who will then actually decide to migrate, is a function, called $e(h)$, of the actual proportion of individuals already in modern jobs. This function has the following properties:

$$e(0) = 0, e(h) \leq 1, \text{ and } e'(h) > 0 \quad (3)$$

This function $e(h)$ depends on how potential migrants are incited to migrate. Such incentives are grounded in interactions that potential migrants have with non-poor individuals. Therefore, $e(h)$ depends on a potentially complex structure of social interactions between poor and non-poor individuals. The more that potential migrants can interact with workers employed in the modern sector, the more they will expect a positive outcome from their migration, and the more they will decide to migrate. Hence the assumption that $e(h)$ has a positive slope.

It follows from equation (3) that the proportion of new migrants during a small period of time, dt , is

$$dm = (1 - h)e(h)(1 - F(\theta - y_L))dt \quad (4)$$

This change in supply in the modern labor market will eventually, through a standard market equilibrium process and depending on price elasticities, change the amount of labor force employed in the modern sector.

$$dh = \frac{\varepsilon_D}{\varepsilon_D + \varepsilon_S} (1 - h)e(h)(1 - F(\theta - y_L))dt \quad (5)$$

Where ε_D and ε_S are, respectively, the absolute values of demand and supply price elasticities in the modern labor market.

Given the linear relationship between $y - y_L$ and h (equation 1), this differential equation corresponds to a dynamic process that is characterized by a growth rate equal to 0 when $h=0$ and when $h=1$, and is strictly positive otherwise, implying at least one growth acceleration when individuals start escaping poverty; i.e. when h starts a little higher than 0.

To obtain more precise results we need some more specific assumptions. First, consistently with the assumption of a fixed y_{th} we assume that ε_D is infinite so that $\frac{\varepsilon_D}{\varepsilon_D + \varepsilon_S} = 1$. In that case, the uniqueness

of acceleration is guaranteed if $e(h)$ is quasi-concave. To illustrate this with a mathematically tractable solution, we specify $e(h)$ as follows.

We assume that prospective migrants get information about the existence of modern job possibilities from their network (e.g., members of their villages who have possibly already migrated). We further assume that each individual has a network of N other individuals (with $N \geq 0$), who are independently and randomly distributed in the traditional and modern sectors with the same distribution as the general population. A prospective migrant can observe whether any member of his network has a job in the modern sector. The probability that at least one member of the prospective migrant's network has a job in the modern sector is $1-(1-h)^N$. In this event, the likelihood that the prospective migrant gets a job in the modern sector after migration can be relatively high. More precisely, we assume that this likelihood is high enough to convince the potential migrant to decide to migrate. Conversely, if he finds none of his network members working in the modern sector, he will not expect to find a modern job after migrating and will then decide not to migrate. Hence the proportion $e(h)$ of potential migrants who will decide to migrate is:

$$e(h) = 1 - (1 - h)^N \quad (6)$$

In this specific case, the dynamics of h follows a generalized logistic curve, whose equation as a function of time t is:

$$h(t) = 1 - \left(1 + e^{(\alpha t + \beta)}\right)^{-1/N} \quad (7)$$

Where β is a constant of integration parameter and $\alpha = \frac{\varepsilon_D}{\varepsilon_D + \varepsilon_S} (1 - F(\theta - y_L))$.

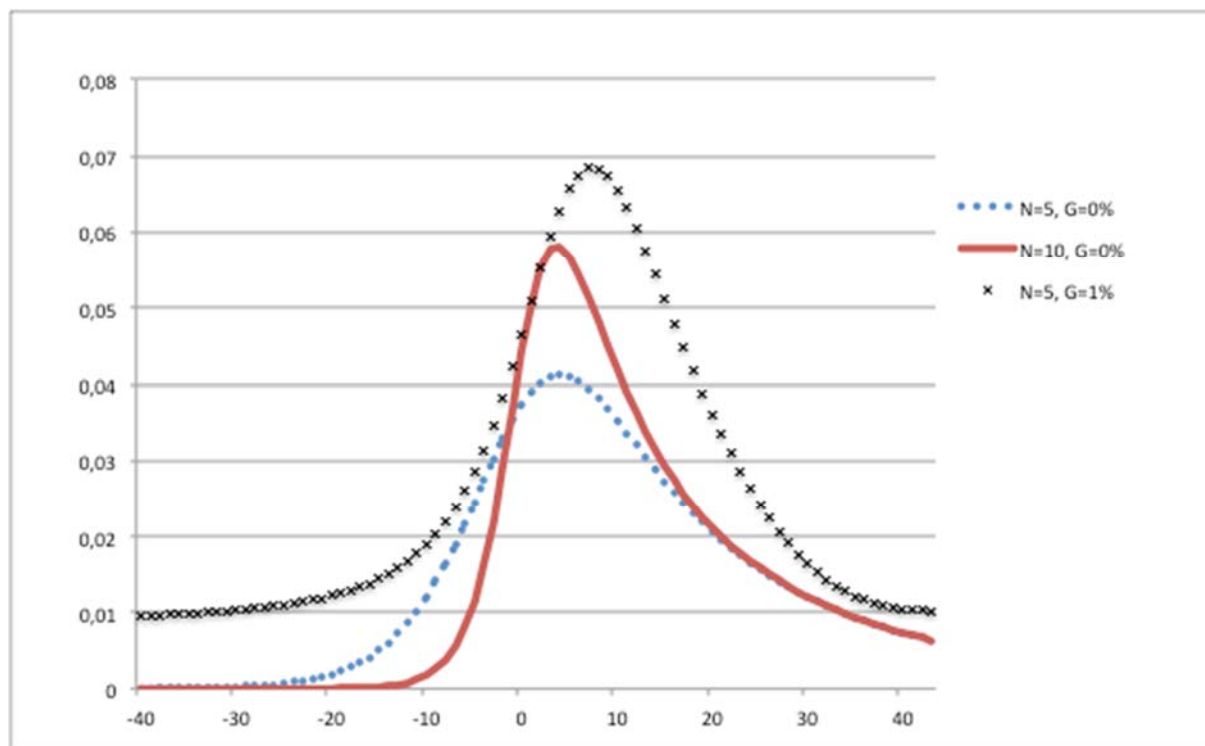
The average income $y(t)$ moves from a lower bound y_L to a higher bound y_H , and its growth rate is equal to:

$$g(t) = \frac{dy(t)}{y(t)dt} = \alpha \left(1 - \left(\frac{y_H - y(t)}{y_H - y_L}\right)^N\right) \frac{y_H - y(t)}{y(t)} \quad (8)$$

This equation describes a growth acceleration: g increases from zero when y is close to y_L , with an acceleration (defined as the instant rate of change of the growth rate) equal to αN , up to a point where it culminates, and it then decreases back to zero when y tends to y_H , with a negative acceleration equal to $-\alpha$.

Such dynamics are illustrated in Figure 1, where we have assumed that positive shocks push 5% of the poor above the poverty line each year, that 80% of those who migrate find a job in the modern sector, and that the workers in the modern sector have, on average, an income that is four times as large as is the average income in the traditional sector. For values of N between simulation is only illustrative, but it shows that the magnitude of growth accelerations at work in this model is reasonable. 5 and 10, such simulations lead to growth rates accelerating up to 4% and 6%, respectively. Of course, this

Figure 1: Simulation of acceleration dynamics



The model can be easily generalized to take into account possible dropouts from the modern sector; i.e. the possibility that some individuals initially in the modern sector would have to go back to the traditional sector due to adverse shocks. Following Dasgupta and Ray (1988), we can conceive this dropout effect in an efficiency-wage model in which the work-capacity of individuals depends on their income. In this framework, dropouts may be related to adverse income shocks that would reduce the work capacity of some individuals to the extent that they would become unemployable in the modern sector. Hence, we define a reverse migration dr :

$$dr = -F(y_H - \theta')hdt \quad (13)$$

where θ' defines the actual income below which modern sector workers become unemployable. Then, equation (5) becomes:

$$dh = \frac{\varepsilon_D}{\varepsilon_D + \varepsilon_S} \left((1-h)e(h)(1 - F(\theta - y_L)) - F(y_H - \theta')h \right) dt \quad (14)$$

Acceleration is possible if this derivative is positive when h is close to zero, which implies:

$$e'(0)(1 - F(\theta - y_L)) > F(y_H - \theta') \quad (15)$$

Otherwise, the effect of adverse shocks on workers in the modern sector always overcomes the effect of favorable shocks on workers in the traditional sector, and there is no exit from the poverty trap at the aggregate level.

Assuming that condition (15) holds, we obtain an acceleration process similar to the previous one: when h starts from a small but positive value, it increases up to the point h^* , where

$$e(h^*)(1 - F(\theta - y_L)) = F(y_H - \theta') \frac{h^*}{1-h^*} \quad (16)$$

This point is reached before $h=1$, as long as $F(y_H - \theta') > 0$, because, at $h=1$, dh/dt is strictly negative. In the case where $e(h)$ is quasi-concave there is a unique non-trivial solution to equation (16), as $\frac{h}{1-h}$ is convex. This solution corresponds to a situation in which dualism persists in the long run. It could also illustrate the notion of the middle-income trap, which has been recently explored in the empirical growth literature (Eichengreen et al., 2013).

In summary, our model of migration from the traditional to the modern sector shows that poverty exits associated with such migration may lead to growth accelerations. Such properties are related to the existence of an indivisible fixed cost (of migration and/or job search) associated with financial constraints. Overcoming this barrier requires a push factor. These properties also rely on social interactions, which determine a pull factor of migration. In the absence of social interactions of potential migrants with individuals employed in the modern sector, the function describing migration decisions, $e(h)$, is independent from h . Hence, the rate of growth of poor individuals is constant and negative or equal to 0. If it is strictly negative, this implies a deceleration of growth. It is equal to 0 in our particular specification of $e(h)$ in equation (6), where the absence of social interactions would be represented by the limit case $N=0$. In that case, the proportion of poor in the total population stays constant.

In conclusion, the acceleration properties of our model depend specifically on these two ingredients associated with push and pull factors: the existence of an initial fixed cost that cannot be financed through borrowing, and social interactions between poor and non-poor that shape the dynamics of poverty exits. Other models with the same ingredients would have the same properties. In particular, we would have very similar properties in a model of adoption of innovation, which would typically exhibit the same logistic dynamics. Adopting an innovation entails initial investment costs, and the dynamics of adoption rely on an interaction of late adopters with early adopters, based on a process of learning through information gathering [see, e.g., Feder et al., (1985), for models of adoption of innovation in agriculture].

So far, in this framework, economic growth comes only from poverty reduction, i.e., an increase of h , which causes economic growth, and not the other way around. The model can be easily further enriched to incorporate the possibility of exogenous sources of economic growth, which would be equivalent to technological progress in both the modern and the traditional sectors, increasing parallelly y_H and y_L over time. This reinforces the accelerated growth in the economy through poverty exits that are now triggered also by the decline of θ/y_L , followed by a continuous increase of the parameter α . This is illustrated in Figure 1 in the case of $P=5$ and G (exogenous growth rate)=1%, built under the assumption that shocks are normally distributed.

In our framework, summarized in equation (5), poverty exits can result from a variety of exogenous events, pushing $1-h$ above 0 . When they occur, such poverty exits generate growth acceleration, which is self-sustaining once started. But poverty exits may be also triggered by exogeneous growth, and then partly result also from economic growth. Whether poverty exits result from income growth or occurs independently of it, while causing economic growth, is, at bottom, an empirical question. In the coming sections, we will attempt to identify acceleration episodes that could be associated with exogenous poverty exit episodes, which we will call “independent” poverty exits.

IV. Empirical test: methodology

According to our theoretical model, there could be growth accelerations induced by poverty exits. The idea of our empirical test is to define poverty reductions that can be considered independent from aggregate growth, measure their impact on aggregate growth as predicted by our model, and test whether such predicted impacts can be associated with growth accelerations. We proceed in three steps:

- Determine the theoretical impact of poverty exits on aggregate growth;
- Identify which part of poverty exits can be considered as independent from aggregate growth;
- Correlate the outcome of the previous steps, i.e., the impact of independent poverty exits on aggregate growth, with acceleration events.

The first step is a direct application of our analytical framework. In this framework, any poverty exit, which corresponds to a positive change Δh of the proportion of non-poor individuals, would increase the growth rate of the economy by

$$\gamma = \frac{y_H - y_L}{y} \Delta h \quad (17)$$

The second step amounts to identifying which part of poverty exits can be considered independent of aggregate growth. Δh can result from the growth process, and we should restrict our analysis to “independent” poverty exits, i.e. to poverty exits that would be exogenous to aggregate growth. To this end, we use the methodology proposed by Datt and Ravallion (1992) and define independent poverty exits as the change in poverty incidence that would result from changes in the Lorenz curve while keeping the aggregate income level constant. To this end, we start by defining poverty incidence ($P=1-h$) as a function of aggregate income and of the vector of parameters defining the Lorenz curve, called $L(t)$

$$1 - h(t) = P(y(t), L(t)) \quad (18)$$

Then the independent poverty exit is, between t and $t+1$:

$$\widehat{\Delta h}(t) = P(y(t), L(t)) - P(y(t), L(t+1)) \quad (19)$$

and its impact on aggregate growth, called $\widehat{\gamma}$, is defined by replacing Δh with $\widehat{\Delta h}$ in equation (17).

$$\hat{\gamma} = \frac{y_H - y_L}{y} \widehat{\Delta h} \quad (20)$$

The final step requires that we identify growth acceleration events. We do so by applying the method proposed by Hausmann et al. (2005). They identify growth accelerations by looking for rapid growth episodes that satisfy the following conditions.

- (1) $g_{t,t+n} \geq 3.5$ ppa, growth is rapid,
- (2) $\Delta g_{t,n} \geq 2.0$ ppa, growth accelerates,
- (3) $y_{t+n} \geq \max\{y_i, i \leq t\}$, post-growth output exceeds pre-episode peak.

where they define the growth rate $g_{t,t+n}$ at time t over horizon n as the least squares growth rate of GDP per capita (y) from t to $t+n$, and where n is set to 7. The year of onset, or the start year, of the acceleration is chosen by finding the year that maximizes the F-statistic of a spline regression with a break at the relevant year.

We apply these criteria to data available in the Penn World Tables 9.0, which offers us the possibility of identifying acceleration start years up to 2007.

Our variable $\hat{\gamma}$ measures the possible impact of independent poverty exits on aggregate growth. At the start of acceleration episodes, we should observe not only positive growth but also an acceleration of growth, i.e., a positive change of the growth rate (this corresponds to condition (2) above). At such start dates, accelerations are triggered by poverty exits if we observe a positive time variation of $\hat{\gamma}$. Additionally, in the very first years of an acceleration episode the growth rate computed on a year on year basis is inevitably low (even though it is high from year t to $t+n$). Hence, we have to test whether starts of acceleration episodes are associated with high values of $\Delta\hat{\gamma}$, instead of with high values of $\hat{\gamma}$.

V. Empirical test: data and results

To obtain estimates of growth accelerations triggered by independent poverty exits, $\Delta\hat{\gamma}$, we use information on income distribution that is available from the World Bank Povcalnet¹ webpage. This data source provides information at different dates on the average income/consumption (that we call y),² the poverty headcount, and the poverty gap, from which we can infer the average income of individuals both under the poverty line (y_L) and above the poverty line (y_H). Given that the Povcalnet

¹ Source <http://iresearch.worldbank.org/PovcalNet/index.htm?0>

² Data are available either on consumption or on income, depending on the surveys used. We implement our calculations separately on the sub-sets of observations related to incomes only and of observations related to consumption only, and merged the results of these calculations in the end, which amounts to assuming that variations of poverty measured on incomes and on consumptions are comparable.

webpage provides such information for any poverty line, we can also use it to observe the Lorenz curve at each date and then compute $\hat{\gamma}$.

The Povcalnet webpage provides such information for a large number of countries, but with a variable time frequency. As a consequence, $\hat{\gamma}$ is not observed on an annual basis but for variable periods of time. To obtain comparable and complete estimates for the different countries and years, we convert the available estimates of growth rates induced by independent poverty exits on an annual basis (by dividing the computed $\hat{\gamma}$ by the length of the period within which it is computed) and we assume that $\hat{\gamma}$ is constant between two contiguous dates of actual observation. This is, accordingly, an approximation, but this approximation only creates a measurement error in our data. Finally, to obtain our variable of interest, we calculate the variation $\Delta\hat{\gamma}$ between two contiguous dates of actual observation of the income distribution and we attribute it to the whole period between these two dates. This introduces a further element of approximation, as the time distance between two contiguous observations of the income distribution is variable across countries and over time. In section 6, we propose an alternative way to deal with this issue, at the cost of a reduction of the number of observations, but with similar results.

Once we have defined our variable of interest, the next step is to correlate it with growth acceleration episodes.

We start by testing the difference of $\Delta\hat{\gamma}$ between episodes of starts of accelerations and non-acceleration periods. We follow Hausmann et al. (2005) by defining episodes of starts of accelerations as the years when the accelerations start together with the years that immediately precede and immediately follow these events (i.e. year $t-1$, t and $t+1$ if acceleration starts at t). We also follow Hausmann et al. (2005) in excluding the 6 observations that follow immediately the starts of acceleration periods (years $t+2$ to $t+7$).

The test of difference reported in Table 1 clearly shows that $\Delta\hat{\gamma}$ is significantly higher in episodes of starts of accelerations than in non-acceleration periods, which is consistent with our theoretical predictions.

Table 1: comparison of $\Delta\hat{\gamma}$ in acceleration starts and non-acceleration periods

Group	number of observations	Mean	Std. Err.	[95% Conf. Interval]
acceleration episode	196	0.216	0.107	0.005 0.426
no acceleration	1,270	-0.184	0.075	-0.330 -0.037
combined	1,466	-0.131	0.066	-0.261 -0.000
difference		0.400	0.195	0.018 0.781

As reported in Table 1, $\Delta\hat{y}$ is significantly positive during starts of acceleration and negative otherwise; the difference of means between the two sub-samples is also significantly positive.

We illustrate this result in Figure 2, where we show the kernel distribution of $\Delta\hat{y}$ in the two sub-samples. To improve the legibility of this graph, we drop observations with an initial poverty incidence that is lower than 20%. By definition, we cannot expect large accelerations driven by poverty exits in countries where the poverty incidence is already low initially. We also drop extreme positive and negative values, which have no significant effect on results reported in Table 1 but that would otherwise squeeze the scale of the graph.

Figure 2: distribution of $\Delta\hat{y}$ in acceleration starts and non-acceleration periods

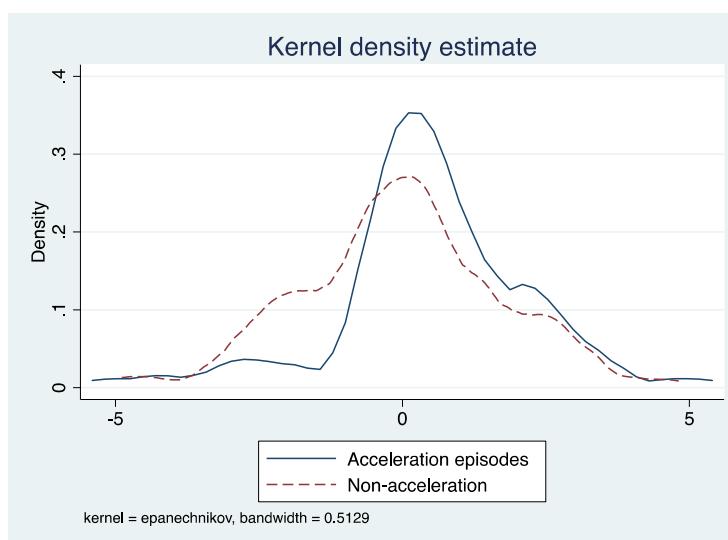


Figure 2 shows clearly the positive association of acceleration episodes with higher levels of acceleration triggered by independent poverty exits.

Of course, not all accelerations are due to poverty exits. To further test our preliminary result, we introduce several control variables that could influence the probability of an acceleration start. We start with variables identified by Hausmann et al. (2005) as determinants of growth accelerations. Our period of observation is, however, different from theirs, as we take advantage of new observations in the PWT 9.0 database, and, conversely, the Povcalnet data set starts only in the 1980s. Therefore, we had to obtain updates of their variables, which, in most cases, implied using additional sources. We have reasonably close updates for the following variables (see sources and definitions in Appendix):

- econ_lib: economic liberalization
- pos_change: positive political regime change
- neg_change: negative political regime change
- lead_death: natural death of leader
- tenure_death: length of tenure of the leader at time of death
- end_intra_war: end of intra-state war
- end_inter_war: end of inter-state war

Table 2: basis regression results

	(1)	(2)	(3)	(4)
$\Delta\hat{y}$	0.012 (3.27)**	0.009 (1.67)+	0.012 (2.72)**	0.012 (2.28)*
econ_lib	0.038 (1.18)	-0.005 (-0.11)	0.056 (1.39)	0.006 (0.13)
pos_change	-0.036 (-1.21)	-0.061 (-1.68)+	-0.008 (-0.22)	-0.049 (-1.23)
neg_change	0.000 (0.01)	0.069 (0.97)	0.047 (0.73)	0.126 (1.64)
lead_death	0.395 (2.88)**	0.399 (2.40)*	0.223 (1.65)+	0.396 (2.47)*
tenure_death	-0.005 (-1.41)	-0.005 (-1.32)	-0.002 (-0.66)	-0.005 (-1.29)
end_intra_war	-0.036 (-1.16)	-0.051 (-1.39)	0.006 (0.16)	-0.045 (-1.18)
end_inter_war	-0.092 (-2.25)*	-0.125 (-3.04)**	-0.122 (-2.88)**	-0.124 (-2.97)**
financial_lib		0.115 (2.08)*		0.105 (1.83)+
labor_reform			0.093 (2.10)*	0.050 (1.01)
Observations	1096	711	864	637
Acceleration episodes	63	45	55	40
Pseudo R2	0.09	0.13	0.10	0.13

Results of a Probit regression with marginal effects reported. Robustly estimated student test in brackets

** (resp *, +) significant at 1% (resp 5%, 10%)

Our results with this preliminary set of control variables are reported in column 1 of Table 2, where we have also introduced time dummy variables, as in Hausmann et al. (2005) (not shown). Overall, the control variables improve the regression fit. As such they are, overall, a relevant set of controls. However, our results are quite different from those obtained by Hausman et al. (2005). In contrast with their results, we observe a non-significant correlation with economic liberalization, a negative correlation with positive regime change, a positive correlation with leader death, and a negative correlation with the end of inter-state wars.

Other authors who have attempted to replicate the results of Hausman et al. (2005) have also found diverging results. Jong-A-Pin and de Haan (2011) proposed improvements of the political regime change variables, but such improvements do not make any difference in our case. In our case, the most important source of divergence derives from the change of the period of estimation, as our observations start only in the 1980s and continue up until 2007. Economic liberalization was observed in only 15 countries between 1960 and 1980, while it has occurred in more than 100 countries since then (104 countries between 1990 and 2007). As it is defined, economic liberalization

has become the rule rather than the exception, while there are not so many acceleration episodes. The influence of political variables on economic performances has also probably changed since 1990, as more than half of the countries are graded over 5 (in a scale from -10 to +10) in the polity indicator used, while most countries are graded considerably lower than 5 until the end of the 1980s. Also, the nature of war events has changed since the end of the cold war.

We also attempted to include an update of Hausmann et al.'s (2005) terms of trade shock variable, but the updated variable has no positive correlation with growth accelerations (if not a negative one). The fading of Hausmann et al.'s (2005) result for this variable may be due to the change of frequency of commodity market cycles in recent decades (Cashin and McDermott, 2002): up to the 1980s, there were relatively long waves of commodity prices, possibly leading to accelerations of their exporters, whereas, in recent decades, the frequency of such events has been too high to sustain medium-run accelerations. Given data availability constraints, introducing a variable based on terms of trade change in regressions implies a loss of approximately 200 observations, without any gain in terms of explanation of accelerations; therefore, we dropped it from our regressions.

Following Doern and Nunnemkamp (2007) we tested whether aid flows, in ratio to GDP, would be associated with growth acceleration. However, we find a negative association: the countries that have received the biggest aid support, relatively speaking, are also those who have known fewer accelerations. The previous authors acknowledged the possibility of an endogeneity bias, related to the fact that the neediest countries receive more aid; however, in their case, the correlation of aid with acceleration was positive. The reason for our diverging results is again related to the change of the period of estimation. A substantial number of countries have accelerated in the last two decades, and few of them were major aid recipients. Given that the observed negative correlation in our period of estimation is likely the result of an endogeneity bias, we did not keep the aid ratio in our list of control variables.

We also added two more control variables: `financial_lib` and `labour_reg`. These variables are dummy variables for countries exhibiting the widest reforms in two aspects: financial liberalization and labor market reforms. The first variable comes from Christiansen et al. (2013), and the second comes from Adams et al. (2016). In each case, we consider countries whose reform breadth is in the highest decile of the sample as being strong reformers. Column 2 shows a positive correlation of acceleration episodes with financial liberalization. Column 3 shows a positive correlation of these episodes with labor market reforms. This suggests that there are more acceleration episodes in cases of enhanced labor market regulations. In interpreting this correlation, it should be kept in mind that the index is a measure of protective regulation, not of costs, strictness, or rigidities. Additionally, this correlation should not be over-interpreted, as its significance decreases when the two reform variables are put together in the regression (column 4), partly as a result of shrinking of the sample of estimation due to limitations in data availability. Nevertheless, in all cases, the parameter for our variable of interest, $\Delta\hat{y}$, stays stable and significant.

VI. Discussion

In this section, we provide further checks of the robustness of our core result:

- change of the poverty line
- alternative measurement of acceleration triggered by independent poverty exits
- discussion of possible sources of endogeneity bias

In columns 1 and 2 of Table 3, we report results obtained when we change the poverty line from \$1.9 to \$3.1. Results remain robust regarding the parameter of $\Delta\hat{y}$.

In columns 3 and 4 of Table 3, we change our measurement of acceleration triggered by independent poverty exits: instead of measuring it from the current estimation of \hat{y} to the next available estimation, we measure it from the current estimation to the estimation 5 years later. If there are no data available to observe an acceleration in \hat{y} between years $t-1$ and t_4 , that is, if we have the same estimation of \hat{y} in this interval of 5 years, the observation is dropped from the sample. This alternative definition of $\Delta\hat{y}$ improves the quality of our measurement, as it is systematically measured on the same scale of time but at the cost of a reduction of our sample size. We find that our results remain robust to this change.

Table 3: further regression results

	(1)	(2)	(3)	(4)	(5)	(6)
	Change of poverty line to \$3.1		alternat. measurement of acceleration of \hat{y}		control of HIPC initiative	
$\Delta\hat{y}$	0.009 (2.98)**	0.008 (1.95)+	0.010 (2.71)**	0.011 (1.88)+	0.010 (2.59)**	0.011 (2.08)*
econ_lib	0.051 (1.56)	0.029 (0.65)	0.054 (1.48)	0.003 (0.07)	0.058 (1.79)+	0.017 (0.38)
pos_change	-0.033 (-1.12)	-0.052 (-1.34)	-0.018 (-0.53)	-0.030 (-0.67)	-0.016 (-0.54)	-0.026 (-0.64)
neg_change	-0.009 (-0.16)	0.122 (1.59)	0.013 (0.21)	0.135 (1.56)	0.005 (0.10)	0.106 (1.48)
lead_death	0.384 (2.77)**	0.364 (2.27)*	0.361 (2.53)*	0.395 (2.28)*	0.266 (2.11)*	0.335 (2.17)*
tenure_death	-0.005 (-1.32)	-0.005 (-1.18)	-0.004 (-1.04)	-0.004 (-1.05)	-0.003 (-0.86)	-0.003 (-0.98)
end_intra_war	-0.041 (-1.32)	-0.051 (-1.31)	-0.024 (-0.68)	-0.038 (-0.88)	0.001 (0.04)	-0.038 (-1.00)
end_inter_war	-0.093 (-2.17)*	-0.130 (-2.98)**	-0.096 (-2.04)*	-0.128 (-2.65)**	-0.100 (-2.89)**	-0.121 (-3.00)**
financial_lib		0.114 (2.01)*		0.155 (2.44)*		0.095 (1.69)+
labor_reform		0.094 (1.86)+		0.069 (1.18)		0.071 (1.37)
HIPC_completion					0.196 (2.15)*	0.481 (2.67)**
HIPC_eligible					-0.162 (-6.44)**	-0.125 (-3.24)**
Obs	1120	655	953	576	1096	637
Acceleration episodes	66	43	60	39	63	40
Pseudo R2	0.08	0.13	0.06	0.12	0.13	0.15

Results of a Probit regression with marginal effects reported. Robustly estimated student test in brackets

** (resp *, +) significant at 1% (resp 5%, 10%)

In columns 5 and 6 we provide estimates dealing with a possible endogeneity bias related to the Heavily Indebted Poor Countries (HIPC) initiative. In the 1990s, several such countries received large-scale debt relief in exchange for poverty reduction programs financed by such debt reduction. According to our model, and assuming they were successful, such poverty reduction programs may have triggered growth acceleration. However, debt relief, as such, may have improved growth performances independent of poverty exits, as it relaxed the financial constraints faced by these countries.³ Hence, we could have an endogeneity bias arising from the fact that both poverty exits

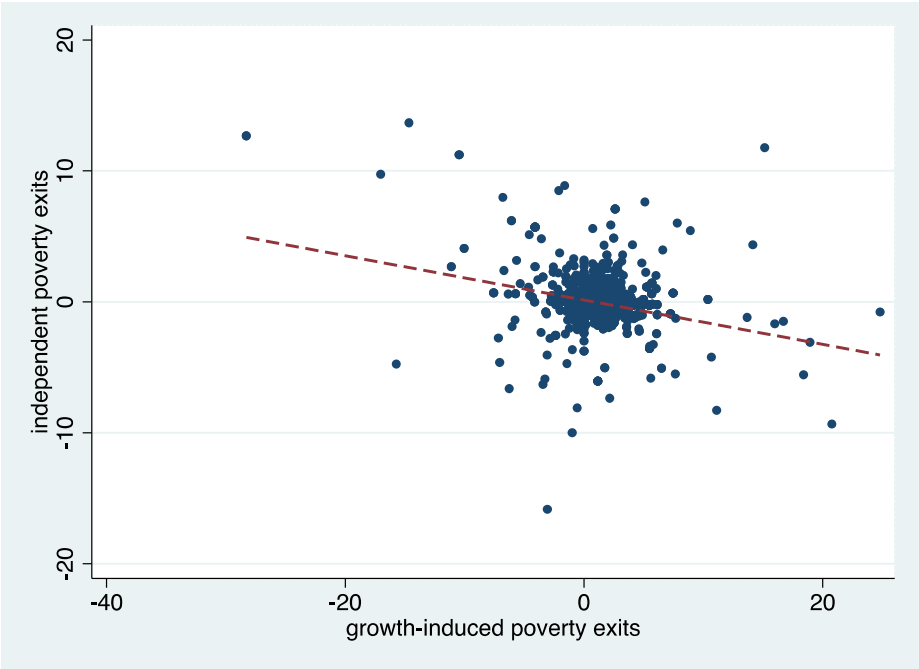
³ Wamboye and Tochkov (2016) provide some empirical evidence of the positive growth impact of the HIPC initiative.

and growth acceleration would be joint consequences of the implementation of the HIPC program. To control this, we have introduced a dummy variable, *HIPC_completion*, equal to 1 for the first 3 years following the point of completion of the HIPC initiative, which varied depending on the capacity of a country to meet the requirements of the program. We have also introduced a control variable, *HIPC_eligible*, for all the countries that were eligible for the initiative: by definition, the outcome of the initiative can be observed only by comparing eligible countries. Eligible countries have, overall, fewer accelerations than do other countries, but they are more likely to accelerate immediately after they reach the completion point. This is what we observe; but introducing these controls does not change our result concerning the parameter of $\Delta\hat{y}$.

Finally, another endogeneity bias could come from a statistical correlation between our measurement of independent poverty exits and aggregate growth. Admittedly, the parameters of the Lorenz curve could be influenced by aggregate growth performances for various reasons that we cannot control. In practice, we observe a small but significant correlation between independent poverty exits and aggregate growth, but this correlation is negative. This is illustrated in Figure 3, where we correlate the independent poverty exits and the symmetrically defined growth-induced poverty exits.

$$\widehat{\Delta h}(t) = H(y(t), L(t)) - H(y(t + 1), L(t)) \tag{21}$$

Figure 3: correlation of independent poverty exits and growth-induced poverty exits



This negative correlation implies that, if our assumption that independent poverty exits are exogenous to economic growth creates any bias, this bias would lead to underestimation of the positive impact of independent poverty exits on the growth process. Hence, this possible endogeneity bias only reinforces our result.

VII. Conclusion

In this paper, we have proposed a simple theoretical model that accounts for the possibility of poverty trap escapes. This model suggests that exits from the poverty trap can contribute to growth accelerations that have been observed repeatedly but have, so far, been only partially explained.

We have proposed an accounting framework to evaluate both the extent of poverty exits that can be considered independent from aggregate growth performances and their possible consequences for economic growth acceleration. In this framework, the acceleration impulses triggered by the growth impacts of independent poverty exits correlate positively with the occurrence of growth accelerations. This correlation is highly significant and robust to various additions of control variables and to changes in the definition of our variable of interest. It also appears to be robust to possible endogeneity bias.

Such results contribute to the understanding of growth accelerations. They also challenge the common wisdom of the existing literature on the growth and poverty nexus, which assumes that growth causes poverty exits, and not the other way around.

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Appendix: Data Dictionary and sources

Data Source	Variable Name	Variable Description
PWT 9.0	episode	dependent variable in the regression, as defined in Hausmann et al. (2005)
Povcalnet webpage (WB)	$\hat{\gamma}$	Growth impact of independent poverty exits, as defined in equation (12). Data to build the Lorenz curve downloaded in November 2017, using income/consumption steps of 10 cents per day.
Polity IV	pos_change, neg_change	Positive and negative political change, as defined in Hausmann et al. (2005)
Archigos Leader Data	Lead_Death	dummy equal 1 for years 0 to 5 after natural death of leader in office. Same variable as in Hausmann et al. (2005), but Hausmann et al. used Jones & Olken (2005) as source data.
	tenure_death	length of tenure of the leader at time of death, as defined in Hausmann et al. (2005)
Correlates of War (COW)	end_inter, end_intra	Dummy variables for years 0 to 5 after a war (interstate or intrastate). See COW manual for a typology of wars. The typology used in COW has changed since the publication of Hausmann et al. (2005)
Economic Liberalisation – Paudel (2014)	econ_lib	dummy for first 5 years of economic liberalization. Definitions closely follow Warczarg & Welch (2008).
Christiansen et al. (2013)	fin_lib	Dummy variable for the highest decile of financial reformers, where financial reform is measured by change of the aggregate financial reform index over the past 4 years
Adams et al. (2016) CBR of labor market reform	Labor_reform	Dummy variable for the highest decile of labor market reformers, where labor market reform is measured by change of the weighted average of the 40 indicators in the CBR labor market dataset over the past 4 years. Weighting is done to ensure equal representation of each sub-area of the index, as suggested by Deakin et al.
IDA & IMF, various annual HIPC and MDRI status of implementation reports	HIPC_compl, HIPC_eligible	dummy=1 for 3 years after a HIPC completion point, and for countries eligible for the HIPC initiative

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