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DEPARTMENT OF ECONOMICS

Working Paper

Sustained Investment Surges

by

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Juan Antonio Montecino
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Working Paper 2017-09



**UNIVERSITY OF MASSACHUSETTS
AMHERST**

Sustained investment surges*

Emiliano Libman[†], Juan Antonio Montecino[‡], Arslan Razmi[§]

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Abstract

Existing empirical studies have focused on determinants of investment. We focus instead on *episodes* of accelerated capital stock growth that last eight years or longer. We find that episodes are relatively common, even in low growth regions, but more so in middle income and Asian countries. After identifying 175 such episodes between 1950-2014, we employ probit analysis to explore their characteristics. Turning points in investment tend to be preceded by undervalued real exchange rates, macroeconomic stability (low inflation), and net capital outflows (especially portfolio outflows). We also find strong evidence for a negative correlation with the capital to output ratio and per capita GDP, and a positive correlation with a human capital index. Investment surges appear to be associated with accelerated structural change in the economy.

JEL Codes: E22, F41, E20

Keywords: Investment, accumulation, real exchange rate, terms of trade

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1 Introduction

Economists have recognized the central role of capital accumulation in determining growth since the early nineteenth century at least. Indeed, any discussion of growth or development-related issues is incomplete without a mention of investment. The country-level determinants of investment, however, remain controversial. While earlier studies tended to focus on aggregate variables such as the cost of capital and aggregate demand, the literature since the eighties has been dominated by micro-founded, intertemporally optimized models, often incorporating capital market imperfections, irreversibility, convex adjustment costs, and financial constraints.¹ More recent literature has explored the role of economic and political institutions broadly defined.

This paper takes a different approach to the question. Instead of focusing on the effect of correlates on the level of investment, we direct attention to the identification of country-level episodes of *sustained* capital stock growth. After some informal analysis, we use probit and logit regressions to identify variables that significantly affect the probability of an investment episode taking place. We then explore the dynamics of sectoral employment and value added before, during, and after the identified episodes. Lastly, we analyze the determinants of episode sustainability.

The existing theoretical and empirical literature identifies several determinants of investment. One could alternatively locate these determinants in financial markets, in the markets for goods and services, in factor markets, or in the broader landscape of institutions and macroeconomic policies. The classical approach emphasizes the profit rate. In the traditional Keynesian approach to business cycles, expectations of future aggregate demand conditions play a central role along with uncertainty and the cost of capital. Neoclassical models, as elaborated by Jorgenson (1963) and later work, are based typically on firms that choose capital and labor inputs to maximize the net present value of future cash flows, and assign a central role to relative factor prices in determining the long-run value of the capital-labor ratio. Diminishing returns to capital ensure that, in the simplest set-up without technological change or population growth, the rate of capital stock growth is similar across long-run steady states. Literature developed in the 1980's and 90's extended the seminal contribution of Romer (1986) to explore the role of increasing returns to scale.

In more recent microfounded models with rational agents that optimize over an infinite horizon, the time path of investment is determined by consumption-smoothing behavior and convex capital stock adjustment costs, but shocks to permanent income can influence the trajectory of saving and investment. Other complications incorporated in the recent literature include the irreversible nature of investment in capital goods, uninsurable idiosyncratic risks, financial market imperfections, and the lumpiness of investments, among others.²

¹Strictly speaking convex adjustment costs are a friction, but they are necessary to avoid abrupt jumps in the level of the capital stock in models that use continuous time, so they are a standard component of an otherwise frictionless model. Other approaches, such as Nickell (1978) and Skott (1989, chapter 4) rely on firm heterogeneity, and have non-convex adjustment cost at the firm level, but a smooth investment function at the aggregate level.

²Empirical studies such as Benhabib and Spiegel (2000) have also incorporated the level of financial and institutional development as a determinant of investment.

Open economy considerations add further complexities since investment in this case is not constrained by domestic saving.³ A positive terms of trade shock, for example, could boost investment by increasing the marginal product of capital in the export sector. The increase in investment may be financed partly or fully by domestic savings, depending on whether the shock is temporary or permanent and, in a microfounded, intertemporal framework, whether the intertemporal elasticity of substitution is low or high.

Valuable as existing theoretical and empirical studies are, most of these do not appear to give adequate weight to the unstable nature of investment, even though the role of investment fluctuations over the business cycle is widely recognized. Indeed, extended upturns and downturns in investment appear to be a fact of life. Countries experience phases of high and low investment, and similar saving rates across countries tend to give rise to significantly different investment rates. Moreover, differences in investment rates among seemingly similar countries tend to be persistent.

Table 1 highlights some of these facts. For example, while East Asia experienced investment-GDP ratios of 31.7 percent over the period 1960-2014, accumulation in Latin American and Caribbean countries stagnated at 20.9 percent, and South Asia experienced an even lower average rate. For the group of countries identified as “middle income” by the World Bank’s *World Development Indicators* (WDI), gross fixed capital formation as a proportion of GDP varied between an average of 9.8 percent for the lowest 5 countries (Yemen, Angola, Dominica, Guatemala, and Ukraine) to 48.9 percent for the top 5 (Zambia, Rep. of Congo, China, Bhutan, and Suriname) in 2015. Even within regions such as Latin America and East Asia, there is significant variation in the levels of investment across countries and over time.

Given this evidence, identifying the nature of the turning points in investment could yield interesting insights into the growth process. Let us think, for example, in terms of the Solow growth model with exogenous technological change. In the steady state, the capital to output ratio (in terms of the effective labor force) is constant, as is the capital to labor ratio. Factors that affect savings could affect the steady state level of output per capita but only through the transitional dynamics. These inter-steady state dynamics, however, could last for significant periods of time. For example, employing the Cobb-Douglas version of a general form production function, assuming a one-third income share of capital, and assuming the rates of capital depreciation, labor force growth, and technological progress to be 4, 1, and 2 per cent, respectively, yields a half-life of approximately 15 years.⁴ Thus, deviations from the equilibrium level of per capita output seem to persist for sustained periods of time. Incorporating human capital to increase the capital share to 0.66 changes the number to approximately 29 years. Given the rather long time horizons involved, identifying the determinants of trend changes becomes an interesting exercise.

In models with endogenous growth,⁵ such as the AK family of models, policy changes that affect

³Empirical studies since Horioka and Feldstein (1980), however, have found robust support for a continued strong correlation between investment and domestic saving.

⁴Specifically, $-\ln(0.5)/((1 - 0.33)(0.04 + 0.01 + 0.02)) \approx 14.8$.

⁵In the sense that policy can affect steady state growth rates *permanently*.

investment behavior lead to permanent changes in steady state rates of capital and output growth even in the absence of exogenous technological progress. Making an argument that is relevant to a large subset of our econometric sample, Rodrik (2008) hypothesizes that the tradable sector in developing countries is affected by market imperfections and externalities to a greater extent than the non-tradable sector. A policy of sustained real exchange rate undervaluation, in this second-best world, can counteract these externalities by boosting tradable sector profitability, thus accelerating growth.

Other models feature multiple equilibria, where the relationship between policy variables and investment is not linear since small movements across thresholds can cause switching from a low investment state to a high investment one and vice-versa. Thus, identical initial economic conditions could give rise to different growth rates of capital stock, and a country could be stuck in low or high capital accumulation equilibria for extended periods of time. The factors that push economies on to high accumulation trajectories, therefore, attain particular salience. Benhabib and Gali (1995) provides a survey of this family of models.⁶

On a broader note, models which incorporate deviations from full employment over extended periods of time naturally generate endogenous growth, even in the presence of constant returns to scale and even absent technological progress. The famous Harrod-Domar model, and in the context of a developing economy with underemployment and dual labor markets, the Lewis model, are well-known examples. The endogenous nature of the steady state rate of capital accumulation in these models provides another reason to focus on sharp historical break points in investment rates.

To summarize, both theory and data suggest that there may be considerable room for policy, structural, and institutional factors to affect the trajectory and/or the steady state level of the capital to population ratio. The focus of this paper is on turning points that lead to sustained upsurges in investment. In order to explore the nature of these turning points, we zoom in on long-term trends rather than on short-run fluctuations. We investigate the conditions before, during, and after episodes using several econometric approaches. As discussed in the next section, we rely on several criteria for identifying an investment surge. This approach minimizes the role of volatility, irreversibility, lumpiness and other factors that are likely to render open to criticism empirical specifications based on smooth distributions of underlying variables. It also aims to separate temporary/cyclical investment booms from sustained surges. The goal is to focus on such surges at the country level and, unlike many empirical studies, we include data for both advanced and developing economies. For this purpose, we use capital stock data from the Penn World Tables 9.0, which is comparable across countries and has the largest available coverage.

Several studies have appeared in recent years that identify turning points in macroeconomic aggregates. Hausmann et. al. (2005) identify episodes of acceleration in output growth. Freund and Pierola (2012) carry out a similar exercise for export surges, while Montiel (2000) and Rodrik (2000)

⁶The idea of growth traps appears in variants of the traditional big push model such as Rosenstein-Rodan (1943), Murphy et. al. (1989), and Skott and Ros (1997), where it is the *level* of capital stock that varies between multiple steady states.

analyze consumption booms and saving transitions, respectively. To the best of our knowledge this is the first attempt to identify determinants of sustained investment surges using similar techniques.

The structure of the remaining paper is as follows. Section 2 describes the episode identification methodology and the empirical approach. Section 3 analyzes the factors that precede investment accelerations. Section 4 presents robustness checks and additional results. Section 5 then illustrates the structural changes that typically occur during episodes. Section 6 examines the characteristics of episodes that are sustained beyond the episode years. Finally, Section 7 concludes.

2 Episode Identification

In this section we describe the filter that we use to identify episodes of investment surges.⁷ To be identified as the starting point of an investment surge, a candidate observation must satisfy the following criteria: a) annual per capita capital stock growth over a 8-year period must be over 3.5 percent; b) annual per capita capital stock growth must have accelerated by at least 2 percentage points during the 8-year period; and c) the level of capital per capita 8 years after the end of the acceleration episode must exceed its historical peak.

Criteria (a) ensures that the capital stock per capita grows at a rapid rate. Criteria (b) ensures that the growth rate deviates significantly from the pre-episode average. Criteria (c) avoids picking investment surges that are pure recoveries from periods of capital stock destruction due to events such as war, major political upheavals, and natural disasters.

A few comments are in order here. Applying the criteria to capital per *worker* rather than capital per *capita* yields a very similar picture. The reason is that there is a very high correlation (0.98) between population and employment in the data used in this paper. It is also worth mentioning that criteria (c) is rarely binding.

In light of (a), (b) and (c), the first step is to obtain the fitted growth rate of capital per worker over each 8-year window. Specifically, we estimate the following rolling regression for each country individually:

$$\ln(k_{it}^w) = \alpha_{it}^w + g_{it}^w \cdot t + u_{it} \quad (1)$$

where k_{it}^w is the capital to population ratio, t is a time trend, and w denotes the 8-year rolling estimation window. The parameters α^w and u are the intercept and the error term respectively. The coefficient estimate \hat{g}^w is therefore the fitted 8-year growth rate of capital per capita. This is better than simple averages, because it minimizes the impact of outliers, and it is better than using the median growth rate, because we can capture non-linearities, for instance if the level of the capital stock evolves exponentially (as we should expect during an episode).

We define an investment acceleration episode as one where both the fitted growth rate \hat{g}^w and the acceleration of the capital stock growth ($\Delta\hat{g}^w$) exceed certain thresholds. For our baseline filter,

⁷The data comes from Penn World Table 9.0; this is a large panel of 182 countries spanning the period 1950-2014.

as already noted, we consider the case where capital per capita must grow more than 3.5 percent a year on average over a 8-year window and accelerate by at least 2 percentage points during the same period, compared to the previous 8-year window.

Having calculated the fitted growth rates and after applying the filtering criteria, it is still necessary to identify the beginning year of each episode. This is because in most cases a number of contiguous years will satisfy the growth and acceleration thresholds. For example, a country’s capital per capita may grow on average more than 3.5 percent and growth may accelerate by more than 2 percent over the 8-year windows beginning in 1973, 1974, and 1975. It is therefore important to rule out two of these three candidate years. This is accomplished using Chow tests for each candidate year separately, and then comparing the goodness of fit for each one. Formally, we estimate:

$$\ln(k_{it}) = \alpha_i + [\beta_{1i}(t < \tau) + \beta_{2i}(t > \tau)]t + u_{it} \quad (2)$$

Where $(t > \tau)$ is an indicator function that is equal to one for the candidate year τ and the years afterwards, and zero otherwise, and $(t < \tau)$ is an indicator function that is equal to one for the years before the candidate start year τ and zero otherwise. Equation (2) is a spline regression with a common intercept.

Our routine runs (2) setting τ equal to each year in our sample, and for each country. After obtaining the regression F-statistic, we then choose the candidate year for τ that yields the maximum F-statistic as the starting year of the episode. Notice that we are not testing for structural break; finding the structural breaks is the job of the filter. Furthermore, we do not allow for overlapping episodes. For example, if the starting date chosen by (2) is 1970, but 1975 too satisfies the criteria (a), (b), and (c), we do not consider the latter as another separate episode.

In order to ensure the robustness of the empirical results presented in the next sections we also apply the episode filter using increasingly “stricter” growth and acceleration thresholds. The “strict” filter considers the case where the average annual growth rate of capital per worker exceeds 5 percent and accelerates by at least 3 percentage points. The “very strict” filter then raises the thresholds to 7 and 4 per cent respectively. While the first filter picks up 175 episodes, the second picks up 106, and the third a total of 43.

Figure 1 shows a typical episode detected by the first filter. We choose the case of Botswana because it is know for its recent history of fast growth (see Rodrik 2008). The dashed red lines indicate episode starting years. They clearly look like structural breaks in the series of per capita capital stock. The two episodes start at 1963 and 1985. The solid line represents the level of the natural log of per capita capital stock, so the graph clearly shows that the large changes in the slope are the episode start points.

Tables 2 and 3 include the full list of episodes (using the first, least strict, filter). Episodes appear to be a relatively frequent phenomena. Even countries that are not associated with fast growth (i.e., Sub-Saharan African countries) have experienced several of them as a group. Excluding all

the years during which an episode cannot take place, we find that the unconditional probability of the occurrence of an episode is 2.07%, slightly below the figure reported by Hausmann et. al. for GDP growth (2.68%).⁸

Table 4 displays the unconditional probabilities by decade and region (using the first version of the filter). Overall, Europe and North America have the lowest probability (0.87 per cent) of an episode taking place while the East Asia and Pacific region has the highest (4.01 per cent). The former is what one would expect if there are diminishing returns to capital accumulation; richer economies endowed with larger per capita capital stock tend to grow slower. Among middle and low-income countries, Sub-Saharan Africa and the Middle East and North Africa have the lowest probability (1.98 per cent). In terms of decades, the 1970s and the 2000s yield the highest probabilities of an investment surge (2.86 and 3.24 per cent respectively).

We also estimate the probability of an episode taking place for each quintile of per capita income, where the first quintile consists of the 20% observations with the lowest income per capita in a given year.⁹ As reported in Table 4, countries in the middle quintiles of global income are the most likely to experience an investment surge, while upper income countries have a very low probability (0.91 per cent). This result appears to contradict the literature that suggests that there is a “middle income trap”, but it is consistent with the recent findings of Ye and Robertson (2016), who find that only a small fraction of countries identified as “trapped” are actually in a trap. Not surprisingly, the upper-most income quintile has the lowest probability of the occurrence of an episode.

3 Empirical Analysis

What variables can help explain the turning points in the series of per capita capital stock? Because there is some uncertainty regarding the precise starting date, we create a dummy variable that takes the value of one the first year of an episode, one year before and one year after, and zero otherwise. That dummy variable is included as the dependent variable in a series of limited dependent variable models. The years where an episode cannot take place (i.e., before 1957, after 2007, and years 3-7 after the start of an episode) are excluded.

As control variables we use covariates which reflect external and internal factors, policy stances, and institutional aspects that may trigger a structural change in the rate of capital accumulation. All these variables were selected to control for the potential factors highlighted by the literature on the determinants on investment. Some covariates are defined as averages of the previous 5 years.

⁸The unconditional probability is defined as the ratio of episodes over the number of years where an episode can potentially take place. We exclude the second, third, fourth, fifth, sixth, and seventh year from an episode, because an episode cannot take place then. The years before 1957 and after 2007 are also excluded since, due to the nature of the filter, an episode can only be identified between 1957 and 2007 (there is not enough data before and after).

⁹This procedure avoids the obvious problem of comparing the income of a country in 1950 with the income of the same country in 2000, because the distribution is computed for each year separately. Thus, even if Congo doubled its per capita income from 1950 to 2000, what matters is the per capita GDP compared to the per capita GDP of the rest of the sample in each year.

We describe these main control variables in some detail, and the next sub-section presents the probit analysis to explore factors that trigger episodes. Table 5 contains a short description of the variables, as well as their sources:

1. To control for macroeconomic conditions and economic policy, we include an undervaluation index (*Underval*) based on Rodrik (2008), the degree of fiscal procyclicality (*Fiscal*), the capital to output ratio (*Capital_Output*), the rate of inflation (*Inflation*), and an index of exchange rate stability (*XR_Stability*).¹⁰ The expected sign of *Underval* is positive, as a recent literature suggests that real exchange rate undervaluation may favor investment (see, for example, Rodrik 2008 and Razmi, Rapetti and Skott, 2012a). The capital to output ratio is included to capture both: (i) the accelerator effect, i.e., that fast past output growth increases the likelihood of an episode due to demand-side effects on investment, and (ii) the average productivity of the capital stock. In either case, any increase in the capital to output ratio will reduce the likelihood of an episode. Regarding fiscal procyclicality (measured as the correlation of the de-trended government consumption to de-trended GDP), we expect a negative sign, as more pro-cyclical policies increase the volatility of the economy, and higher volatility may increase the required rate of profit to justify investment decisions. The relation between inflation and growth may be non-linear, so that the expected effect of inflation is positive when inflation accelerates from very low levels, but negative once inflation hits a threshold that the literature places somewhere between 20-40 percent (Bruno and Easterly, 1998). Finally, exchange rate stability can favor investment, but a stable exchange rate may reflect the adoption of hard pegs which are notorious for exhibiting a tendency towards real exchange rate overvaluation and crisis. However, we also control for crisis and real exchange rate undervaluation, so more exchange rate stability should have a positive (partial) effect on capital accumulation.
2. To control for external factors, we include a variable that captures net capital flows to GDP (*NET_Inflows*), the FED reserve Federal Funds interest rate (*FFend*), an index of the US stock market volatility (*Global_uncertainty*), an index of terms of trade (*TOT*), the “de facto” degree of trade openness (*Trade*), and the degree of capital account openness (*KA_open*).¹¹ The expected sign of capital inflows is ambiguous, as they could increase total investment, or they could crowd-out productive investment if flows are mainly portfolio flows (i.e., they can appreciate the real exchange rate and reduce manufacturing investment). For the same reasons, the sign of the degree of capital account openness is also ambiguous. To gain further insights,

¹⁰To compute the undervaluation index, we follow Rodrik’s three step procedure: i) we construct a real exchange rate index using relative prices from PWT 9; ii) we regress our real exchange rate index on per capita GDP and a set of time fixed effects; iii) we estimate the residuals from the previous regressions to construct the undervaluation index. A positive residual denotes “undervaluation”, while a negative residual denotes “overvaluation”.

¹¹The original data on capital flows comes from Broner et. al. (2013), and it is presented as a ratio of the trend of nominal GDP, to reduce the influence of short-run fluctuations and presumably the effects of price and exchange rate changes. Because the balance of payments data is current dollars, GDP at current prices should be used.

in the next step, we replace capital inflows by the variables (*Port_Inflows*), (*FDI_Inflows*), and (*Reserves*) that represent portfolio and FDI net inflows, and the change in gross foreign exchange reserves.¹² Increases in Federal Funds interest rate and in the volatility of the stock market may increase financial constraints and reduce credit, thus we expect them to have a negative effect on capital accumulation. Higher terms of trade can boost investment in favored sectors, but they can also have negative repercussions due to “Dutch Disease” effects. Finally, countries that are more open to trade can exploit the resulting static and dynamic gains from allocative efficiency. However, in the past some inward oriented strategies also featured very fast growth thanks to a protected manufacturing sector (e.g., Brazil in the 1960s and 1970s), so the expected sign of the trade variable is also ambiguous.

3. To control for other internal factors, we include a variable that reflects the occurrence of crises (banking, currency, debt, etc.) in the 5 years before an episode (*Crisis_5y*), the GDP share of natural resource rents (*Rents*), and per capita GDP (*Capita_GDP*). The expected sign of the crisis variable is negative, as the presence of crises may severely disrupt long-term prospects, depressing investment. The variable (*Rents*) proxies for natural resource availability or for natural resource dependence, and as such it can have opposite effects on capital accumulation; an increase in the stock of natural resources that can be profitably exploited may enhance investment in natural-resource intensive sectors, but it may also generate “Dutch Disease” effects, reducing investment in the manufacturing sector. Finally, the expected sign of per capita GDP is negative in the presence of convergence effects.
4. To control for institutional characteristics, we include a human capital index (*Human_Capital*) and the durability of the political regime (*Durable*).¹³ We expect a positive effect of greater human capital on the likelihood of an episode, especially if a country starts from a low level of development. However, it is also possible that growth may require a minimum level of educational attainment, so additional years beyond a certain threshold do not contribute much. Regarding the durability of the political regime, the expect sign is ambiguous; while political and institutional stability can generate investor confidence, these can also lock in policies that are not conducive to economic growth.

Table 6 defines the control variables and presents their summary statistics, as well as their expected effect (+/-) on the likelihood of an episode taking place. In the following sections we present the baseline specifications, robustness tests, and additional results.

¹²The variables *Port_Inflows*, *FDI_Inflows*, and *Reserves* are constructed using a similar logic to *NET_Inflows*, and they contain the 5-year average of net portfolio and net FDI inflows, and the change in the foreign exchange reserves, divided by trend nominal GDP. The same procedure was used to construct the variable *NET_Inflows*.

¹³The human capital index from PWT 9.0 is based on years of schooling (Barro and Lee, 2013) and the returns to education (Psacharopoulos, 1994). We tried other variables related to the quality of the institutions (such as the prevalence of civil wars and indexes of the quality of democracy), but they often result in non-significant coefficients, and their signs change depending on the specification.

3.1 Episode Determinants: Baseline Results

To analyze the determinants of sustained investment surges, we introduce our episode dummy as the dependent variable in a series of probit regressions that feature the set of control variables described in the previous sections. Table 7 shows the baseline results.

Our findings suggest that some variables consistently stand out as statistically significant at standard levels.¹⁴ More precisely:

1. The degree of real exchange rate undervaluation (*Underval81*) correlates positively with the likelihood of an investment surge episode taking place. A one percent increase in the undervaluation index raises the probability of an episode by between 1.2 to 8.0 percent, depending on the specification. These results are almost always statistically significant.
2. The capital to output ratio (*Capita_Output*) correlates negatively with the likelihood of an episode. A one percent increase decreases the probability of an episode by between 5.8 and 14.7 percent, depending on the specification. This is a large effect, and these results are always statistically significant at 1 or 5 per cent, which suggests that the accelerator effect or capital productivity are important drivers of sustained capital accumulation.
3. The ratio of net capital flows to the nominal trend of GDP (*NET_Inflows*) in the previous 5 years significantly decreases the likelihood of an investment surge. The average marginal effect varies between -0.337 to -0.796; a 1 per cent increase in the ratio of capital flows to GDP reduces the likelihood of an episode taking place between 33 and 80 percent points, a very large effect. Notice that when we include portfolio flows (*Port_Inflows*), FDI flows (*FDI_Inflows*), and the change in Reserve assets (*Reserves*) separately (column 4 and 5), only the portfolio flows are statistically significant. This suggests that (possibly “speculative”) portfolio flows, and not productive FDI flows seems to produce the observed result.¹⁵
4. Higher inflation appears to reduce the probability of an episode taking place. The effect ranges from -0.058 to -0.079, although not all the coefficients are significant at standard levels, and the last two are significant only at 10 per cent. In words, a 1 percentage increase in the

¹⁴Throughout this paper we use probit as the baseline model, and we report the average marginal effect. Reporting the marginal effects holding the other variables at their sample means is another common option, but some of our results (in particular when our sample becomes small due to the inclusion of covariates with limited coverage) feature very low coefficients. This is specially true for the estimations that use the second and third versions of the filter. However, this creates an additional complication, as some of the programs for the models from the logit family presented in table 18 on the Appendix, the Re-logit and the Firth Logit (see columns 2 and 3), do not allow us to estimate the average marginal effects. In that case we report the log of the odd ratios (we explain their interpretation shortly).

¹⁵However, the definition of portfolio flows and FDI flows is based on conventions. Not all the FDI flows are productive. A purchase of less than 10 per cent of the existing assets is classified as “portfolio”, but more for larger purchases the flows are classified as FDI. Moreover, FDI flows include both the purchase of existing assets and new plants.

rate of inflation makes an episode about 5.8 or 7.9 percentage point less likely. This result is consistent with the finding that high inflation is bad for growth (Bruno and Easterly, 1998); however, the relationship is probably non-linear, so our specification may not capture the entire story.

5. Human capital and per capita GDP are positively and negatively associated with the probability of an episode taking place respectively. More precisely, a 1 per cent increase in the human capital index increases the likelihood of an episode by around 13 per cent, while a 1 per cent increase in per capita GDP seems to reduce it by about 6.8-7.1 percentage point. These results are statistically significant at 1 and 5 percent. Thus, higher income make an episode less likely, but a higher stock of human capital makes it more likely.
6. The durability of the political regime seems to reduce the probability of an episode taking place, but by a very small amount. A 1 per cent increase in the duration lowers the probability by 0.1 - 0.2 percent. That is a very small number, and the results are significant at 10 percent in one specification, and at 5 percent in the other. Table 6 indicates that the variable *Durable* ranges from zero to 202 years, with an average of about 22 years. Thus, an increase of 1 year in the durability of a regime (which is equivalent to an increase of 0.5 per cent in the variable *Durable*) lowers the probability of an episode taking place by about 0.5 - 1 percent.

To our surprise, factors such as the terms of trade or the natural resource rents are not statistically significant (at least not consistently) or the size of the effect is very low. The results tell us that natural resources and terms of trade are neither good or bad for accelerated capital accumulation; they are irrelevant.¹⁶

Could reverse causation be an issue? We should note that the structure of the exercise minimizes this possibility. We are looking for correlates from data that precede the investment episodes. Strictly along the time dimension, therefore, reverse causality is probably not an issue. Next, let's take a look at some of the significant variables, starting with the undervaluation index. An investment boom that increases domestic spending in the non-tradable sector should *appreciate* the real exchange rate through the spending channel, for instance in a simple Mundell-Fleming framework. The baseline monetarist framework that incorporates purchasing power parity and some version of the quantity theory should also predict a similar effect through the real balances channel. Moreover, analysis in a portfolio framework with imperfect substitution between money and other assets should lead to qualitatively similar expectations. In all these cases, reverse causality works in a direction that leads us to believe that the effect of undervaluation is, if anything, biased downwards (i.e., capital accumulation is associated with real appreciation).

One could construct a scenario where an *unanticipated* and *permanent* productivity shock in the non-tradable sector leads to both a real depreciation and a boost to investment. It is also possible

¹⁶A word of caution; as in any regression, this could reflect the fact that in some episodes natural resources and terms of trade have one effect while in others they have an opposite and, for the average, offsetting effect.

that future changes in productivity may trigger growth today, so reverse causation is, in principle, possible for the capital to output ratio. However, these channels are unlikely to be important for developing countries – the majority of our sample – where the non-tradable sector tends to be relatively less capital-intensive and underdeveloped financial markets make it harder to invest in anticipation of future productivity shocks.

3.2 Determinants by Country Type

This section explores the determinants of episodes by country characteristics. We separate the sample into manufacturing and non-manufacturing countries. To create the classification, we combine information from the WDI on the manufacturing share of total value added and the manufacturing share of total exports for each country. When both the value added and the export shares for a country are larger than the world average for more than half of the sample period, we classify that country as a manufacturing one for the entire sample (1950-2011). When very little data is available (some countries have less than 10 or even 5 observations for one of the series), we only consider the longer series.¹⁷ The rest of the countries are de facto considered non-manufacturing producers, even if there is no WDI data for them.¹⁸

Table 8 contains the results for manufacturing and non-manufacturing countries. Several features are worth noticing. The degree of real exchange rate undervaluation matters only for manufacturing countries, while it only matters for the last specification for non-manufacturing countries, but the sign is reversed (higher undervaluation harms non-manufacturing countries). The sign of the capital to output ratio is consistently negative in both cases. Human capital is significant for manufacturing countries. This result is consistent with the literature that emphasizes increasing returns and complementarity between human and physical capital in manufacturing. Finally, global monetary conditions and uncertainty appear to affect the non-manufacturing countries only.

In sum, real undervaluation and human capital make investment surges more likely but only for the group of manufacturing countries.

3.3 Tradables versus Non-Tradables

As another exercise, we separate episodes associated with investment booms in non-tradables from those in tradables. Table 9 present the results for episodes of investment in construction (as a

¹⁷When no data exist that country is excluded, except a well known example: there is no data for Taiwan, but we included into the group of manufacturing countries.

¹⁸The final list of manufacturing countries is: Armenia, Austria, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Bosnia and Herzegovina, Brazil, Bulgaria, Cambodia, Canada, China, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, Dominican Republic, El Salvador, Estonia, Finland, France, Germany, Hong Kong, Hungary, India, Indonesia, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Korea, Kyrgyzstan, Latvia, Lesotho, Lithuania, Macao, Macedonia, Malaysia, Malta, Mauritius, Mexico, Morocco, Netherlands, Pakistan, Philippines, Poland, Portugal, Romania, Serbia, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Swaziland, Sweden, Switzerland, Taiwan, Tajikistan, Thailand, Tunisia, Turkey, Ukraine, United Kingdom, United States, and Vietnam.

proxy for non-tradables) and episodes of investment in machinery and equipment (as a proxy for the tradable sector). It is interesting to point out that the filter picks 147 episodes for non-tradable booms, and 268 episodes of tradable booms. Most investment accelerations emerge from the tradable sector.¹⁹

We can see that undervaluation is not consistently significant for the non-tradable case, and the coefficients are smaller. This is in line with the literature that argues that real undervaluations promote expansion of the tradable sector. The rest of the results are similar across both types of episodes, except for terms of trade changes which, consistent with the Dutch disease and resource curse literature, are negatively and significantly related to investment in tradable activities only. Also, while the 5-year crisis dummy has a significant and negative effect on the probability of an episode in the non-tradable sector, the same is not true for the tradable sector. A plausible explanation may be the well-known empirical finding that crises are followed by shifts of resources from non-tradable to tradable sectors. We return to these issues shortly.

4 Robustness checks

We present a set of alternative specifications. We first check the results using OLS instead of probit. The interpretation of the OLS models is a bit tricky. Consider Table 10 and take, for example, the coefficient (0.012) associated with the degree of undervaluation in column 1. In words, an increase of 1 per cent in undervaluation increases the episode dummy by 1.4 per cent, and the result is significant at 1 per cent. As we can see in Table 10, the main plot holds.

For additional robustness checks, we modify the basic filter in different ways. It may be argued that the best criteria for choosing a starting date is simply to pick the first year that meets the three criteria of the original filter. Instead of the Chow test, we therefore choose the first year that is selected by our filter as the starting date. The other sets of specifications change the size of the window from 8 years to 6 and 10 years, and we consider total capital accumulation rather than per capita capital accumulation. These alternative specifications are informative because the size of the window of the original filter is arbitrary, and because total capital accumulation may be an interesting variable in and of itself.

The regression results based on choosing the first year (instead of the Chow test selection), suggest no fundamental differences when compared with the baseline results, except for the statistical significance of some variables. These results are available on request. Table 11 shows what happens when we use 6 and 10 year windows. Changing the window seems to kill the significance of some coefficients suggesting that the factors that explain longer episodes may differ from the factors that explain shorter episodes. We explore the issue of sustainability in more detail in Section 6. The

¹⁹The reader may have noticed that the version of the filter limited to the tradable sector picks a larger number than the original filter (268 episodes versus 175). In other words, the tradable component of capital stock (per capita) satisfies the criteria in 268 instances. This indicates that some episodes that are limited to the tradable sector do not show up once the aggregate capital stock is examined.

results that use total capital instead of capital stock per capita (available on request) are similar to the baseline results except that new variables become significant. For instance, the terms of trade index and the exchange rate stability index are negatively related to the likelihood of an episode taking place, while fiscal procyclicality is positively related. Finally, some coefficients associated with undervaluation become non-significant at standard levels (in the last two specifications).

As another check, we implement the baseline specifications, but using the second and third versions of the filter, which are increasingly stricter (see Table 12). The second filter considers the case where the average annual growth rate of capital per capita exceeds 5 percent and accelerates by at least 3 percentage points. The third filter raises the thresholds to 7 and 4 respectively.²⁰ The main results hold, and perhaps the main exceptions appear using the strictest filter. More precisely, some variables, such as trade openness or exchange rate stability, become statistically significant, while others become non-significant (most notably the variables that capture convergence). Surprisingly, international factors do not have the expected sign (the variable capturing global uncertainty now appears with a positive sign)

The previous specifications do not directly address the issue of non-contemporaneous effects of the different covariates on investment. We have already discussed the issue of reverse causation. By construction, our regressions analyze the impact of the control variables on the near-contemporaneous probability of an episode taking place. The definition of our dependent variable already captures some of the uncertainty regarding the starting point of an episode, and some variables (like those related to capital flows, the crisis variable, and the degree of fiscal procyclicality) are defined as averages over a three or five year period before an episode. But what if an increase in one of these variables a few years ago makes an episode more likely today? We introduce averages of the past five years for some control variables that may have non-contemporaneous effects on capital accumulation, such as the undervaluation index, the capital to output ratio, the terms of trade, the share of natural resource rents, and the net capital flows variables. The results presented in Table 13 suggest that the main plot still holds, although the significance and the size of the effect of undervaluation vanishes in the last two specifications.

5 Episode Structure

The task for this section is to analyze the structure of a typical episode. By “structure” we mean the composition of output and employment. Are there any signs or evidence of structural change somewhere close to the starting date for an average episode? *A priori*, there are reasons to expect an affirmative answer. If, for instance, capital accumulation is driven in developing countries by growth in the modern industrial sector, it is plausible to observe some shift of resources from other sectors, like agriculture, to manufactures.

²⁰Applying the stricter criteria reduces the number of episodes from 175 to 106 and 43; episodes become rarer events as we add covariates. Reassuringly, the Re-Logit and Firth-Logit models (designed to deal with rare events) suggest that this is not an issue. See the Appendix for the results using these models.

We also explore the evolution of exports and imports during an episode. It seems likely that a typical episode will involve an increase in exports, but also more imports of capital goods and intermediate inputs. The trade balance may worsen initially as imports increase faster than exports, although this may depend on the evolution of the real exchange rate.

To investigate the issue of structural change, we show the evolution of the shares of value added and employment of manufactures, agriculture and the tradable sector over time, including years before, during, and after an episode. We plot the mean and the 95 per cent confidence interval (the upper and the lower bound). We consider 3 years before an episode, the 8 year window, and 3 years after. Thus, an episode starts at $t = 4$ and ends at $t = 11$.

The first six charts included in Figure 2 show the evolution of the share of value added for agriculture, manufactures, and the overall tradable sector, which includes the previous two sectors plus the mining sector. The data come from the Groningen Growth and Development Centre.²¹

The data show a clear pattern that involves a falling share of agriculture and an increasing share of manufactures, both in terms of employment and value added. The share of the tradable sector too appears to decline during an episode, both in terms of employment and value added. The decision to include agriculture in the tradable sector drives these results.²² It is useful to keep in mind that our limited sample here includes mainly low and medium income countries. Thus, one could argue that the evidence partly reflects a “Lewisian” story of economy development (Lewis, 1954), where backward economies grow by shifting resources from the agricultural sector – which often displays lower levels and growth rates of productivity – to the modern sector. Given the factor intensity and productivity differentials, this shift is consistent with capital accumulation and economic growth. If there is “hidden unemployment” in the traditional sector during this process of structural change, the re-allocation of resources can take place with little wage pressures, so that profitability in the modern sector remains largely unaffected despite fast capital accumulation. The evidence from value added and employment data is also connected to the results from the previous section. For example, in an open economy set-up, real exchange rate undervaluation is associated with higher profitability in the (tradable) manufacturing sector. The variables associated directly or indirectly with the level of real exchange rates, like capital flows, terms of trade and capital account openness, can affect this profitability.²³

²¹The data are also available from WDI, and it has a broader coverage, but it does not include the level of disaggregation that we need, and it does not include employment.

The full list of countries includes: Argentina, Bolivia, Brazil, Botswana, Chile, China, Colombia, Costa Rica, Denmark, Egypt, Ethiopia, Hong Kong, India, Indonesia, Japan, South Korea, Mexico, Malawi, Malaysia, Mauritius, Morocco, Nigeria, Peru, Philippines, Singapore, Spain, Taiwan, Tanzania, Thailand, and Venezuela. The period spans the years 1950-2011.

²²Excluding agriculture, we observe exactly the opposite. There are good reasons to include agriculture in the tradable sector, but also in the non-tradable sector. In Latin-American and developed countries agriculture is usually part of the modern sector, while in parts of Africa and Asia agriculture is largely part of the traditional sector. Moreover, trade in agricultural products is subject to a much greater extent to tariffs and non-tariff measures such as phytosanitary measures that inhibit trade.

²³Razmi, Rapetti and Skott (2012a) provide an open economy model with a “Lewisian” flavor.

The trends in value added and employment suggest that the process of structural change predates the episode start to some extent. The share of agriculture is declining and the share of manufactures increasing before a typical episode starts. An episode does not necessarily trigger the process of structural change, but rather it seems to be a consequence of the re-allocation of resources from the traditional to the modern sector of the economy. Alternatively, an episode may be responsible for an acceleration of the process of structural change.

The size of the shifts from agriculture to manufacturing suggest that the process of structural change is extremely important during the episodes. In terms of magnitudes, the fall in agriculture seems to be more dramatic than the increase in manufactures, suggesting that other sectors like services also increase their share. For example, comparing the first and the last year of a typical episode, the agricultural shares of value added and employment fall from about 18 and 43 percent to 14 and 35 percent, while the manufacturing shares increase from around 17 and 15 percent to 20 and 16 percent. These are, of course, well-known patterns in the literature on development.

Moreover, there seems to be difference between regions. Although the sample is limited to start with, it is interesting to separate Asian, Latin-American, and African trends. Consider the charts in Figures 3 and 4 which illustrate the composition of employment and value added for episodes by continent. The trends suggest that the importance of agriculture declines for the three regions, and that the largest fall occurs in Africa and the smallest in Latin America. For manufactures, we only observe a consistent increasing trend in value added in Asia.

What happens to exports and imports during a typical episode? The charts included in Figure 5 show a clear pattern: both imports and exports as a share of GDP increase, but imports by more than exports, so that the trade balance worsens from an average of -4 percentage points of GDP to about -7 percentage points. This is driven mostly by a sharp increase in imports, from about 38 to about 46 percent of GDP, while exports increase from 34 to about 39 percent of GDP. Interestingly, imports seems to stabilize at a higher level after the end of an episode, while exports keep growing faster than GDP. This may reflect the lagged effects of greater investment in the tradable industrial sector during surges with exports picking up only gradually over time. Notice that the behavior of the tradable sector observed here is consistent with that of manufacturing and agriculture discussed earlier. We expect that the fast growth of the manufacturing sector requires large imports of capital goods and intermediate inputs that are usually not produced domestically in economies at early stages of development. We also expect a strong positive effect on exports that probably lasts longer than the positive effects on imports, for at least two reasons: (1) once the investment has occurred, imports of capital goods may not need to keep growing as fast as before, and (2) in the case of tradable sector investment, there could be some import substitution.

Considering the shares of exports and imports by region we also observe an interesting heterogeneity between regions. Consider the charts in Figure 6. Only in Asia do we observe a clear upward trend in the share of exports. Imports seems to increase everywhere, but the size of the change seems to be very large in Africa, and not so large in Latin-America. These patterns of

foreign trade may reflect the heterogenous orientation of development across regions (e.g., import substitution vs. export promotion).

To summarize, a typical episode of sustained capital accumulation in our sample features a certain dose of structural change. Output and employment shifts from agriculture to manufactures and services. Imports and exports increase, but imports growth faster, so the trade balance worsens over time. Whether future episodes will feature the same type of structural change is a matter of debate.²⁴ Finally, the structural change in Asia appears to be more manufacturing-oriented and more export-biased than that in Latin-America and Africa.

6 Sustainability of Capital Accumulation After Episodes

Why is capital accumulation sustained after some episodes but not after others? This section extends the original filter to account for the behavior of capital accumulation during the years after the end of an episode. The problem is how to define sustainability. Several definitions are possible. A rather straightforward option is to expand the window to include up to 12 years, instead of the original seven. This reduces the number of episodes to 127. The findings using the baseline probit models while extending the window are reported in Table 14.

Interestingly, most of the main results hold, but most variables are not significant at standard levels, except for undervaluation (although the coefficient is significant at slightly less than 10 per cent), the capital to output ratio, per capita GDP and global financial stability.

A second approach to analyzing the issue of sustainability consists in defining a new dummy variable that is equal to one when the criteria for an episode are met, and when capital per capita growth is at least as fast as 3.5 per cent in the following 8-year window. This criteria yields 85 episodes.

Table 15 includes the new results. More variables are now significant at standard levels, namely the crisis dummy, trade openness, the terms of trade and the FED interest rate. A crisis event in the past 5 years makes a sustained episode about 3.2 and 3.8 percentage points less likely. More closed economies are also associated with sustained episodes; an increase in trade openness of one percent reduces the likelihood by about 1.6-6.3 per cent. An increase in one percent in the terms of trade increases the likelihood of a sustained episode taking place by 4.7-12.1 per cent. Finally, a 1 per cent increase in the FED Rate reduces the likelihood by 0.8-1 percent.

To conclude, the picture that emerges from this section is not very clear, but some factors can be highlighted. Variables associated with the international context (such as international monetary conditions) and domestic crisis partly explain the lack of sustainability of some episodes. There is not much that robustly distinguishes longer-lasting episodes.

²⁴Some recent papers have focused on the increasing importance of services. See for example Eichengreen and Gupta (2011).

7 Concluding Remarks

This paper has attempted to uncover the characteristics of sustained episodes of investment acceleration at the country level. We find that episodes are relatively common, with the typical country experiencing at least one in a 50 year period on average. The likelihood of an episode taking place varies non-linearly with per capita GDP. Advanced economies have a lower probability of experiencing an episode while low- to middle-income countries have higher probabilities. East Asian countries are most likely to experience an episode while African countries are least likely to do so.

Our econometric exercises ask three main questions: What are the determinants of an episode? What happens during an episode? Why do some episode last longer than others? Regarding the first question, the results indicate that sustained surges in investment tend to be preceded by undervalued real exchange rates, high capital-output ratio, low inflation, net capital outflows, and high human capital. We do not find strong evidence that natural resources or terms of trade are significant correlates of investment surges.

These preliminary results were subjected to a battery of robustness tests and checks. The results largely hold using probit, logit and OLS models, and controlling for rare events does not lead to dramatic changes. Employing different specifications and alternative definitions of the filter also leads to similar outcomes. Extending or contracting the episode windows, adding lags, modifying the filter criteria, introducing alternative covariates or using different samples (manufacturing vs. non-manufacturing countries, developed vs. non-developed) does not make a big difference. The exception is that some variables switch from significant to non-significant depending on the specification, but undervaluation, net capital outflows, and the capital to output ratio tend to be resilient.

Regarding the second question, we find evidence of structural change. During an episode, employment and value added shift from agriculture to manufactures, imports and exports increase, but the overall trade balance worsens. These results have interesting implications for the development literature on structural change which has emphasized increasing returns in manufacturing, endogenous productivity change, and movement from low to high productivity sectors during periods of rapid capital accumulation in less advanced economies. However, as a recent literature has suggested, growth and capital accumulation may be more service-led in the future.

Regarding the third and final question, we were not able to find clear patterns that would allow us to distinguish the properties of sustained episodes from those of non-sustained ones. Unobserved variables or changes in the sample may explain the aforementioned difference, but exploring this issue would require more research in the future.

How do our results compare with the existing literature? Although it is very difficult to compare our own numbers with the results of, for example, Hausmann et. al. (2005), due to sample and database differences, our findings suggest that output growth and capital accumulation may often go hand-in-hand. The composition of episodes by income levels and regions, for example, suggest that the lion's share of episodes based on both output and capital growth seem to be located in

East Asian countries, and the fewest in Africa. Furthermore, in line with previous literature, we were able to find some evidence that variables associated with the external sector, such as real exchange rate undervaluation, and low capital inflows, play a role in making an episode a more likely event. These results are in line with Freund and Pierola's (2008) analysis that shows how large real depreciations accelerate manufacturing export growth, and with the observation that growth seems to be correlated negatively with foreign savings as shown by Prasad et. al. (2007).

Tables and Figures

Table 1: Investment and saving across regions as a percent of GDP, 1960-2014

	Gross domestic savings	Gross fixed capital formation
East Asia & Pacific	31.7	28.4
Latin America & Caribbean	20.9	19.7
High income: OECD	23.6	23.7
Middle East & North Africa	29.0	22.1
South Asia	18.7	19.8

Source: World Bank's World Development Indicators

Table 2: List of Episodes

Country	Year	K/L Growth	Acceleration	Country	Year	K/L Growth	Acceleration
Asia & The Pacific				Africa & the Middle East			
Armenia	2001	7.96	6.41	Algeria	1974	5.54	2.87
Azerbaijan	2000	9.73	8.58	Botswana	1963	3.89	5.62
Bangladesh	1994	3.65	2.70	Botswana	1985	7.67	3.03
Bhutan	1981	5.08	2.19	Burkina Faso	1967	3.84	4.24
Bhutan	1989	6.99	2.31	Burkina Faso	2007	6.25	4.33
Brunei Darussalam	1991	3.56	3.32	Cape Verde	1970	6.66	2.46
Cambodia	1998	4.94	4.80	Cape Verde	2006	5.86	2.13
China	1973	5.64	2.32	Comoros	1963	3.85	2.07
China	1990	8.24	2.18	Congo, Dem. Rep.	1970	3.95	4.52
Hong Kong	1962	5.60	2.53	Congo, Dem. Rep.	1979	4.78	2.15
Hong Kong	1979	6.29	2.06	Congo, Republic of	1980	6.93	5.20
India	2000	5.71	2.75	Congo, Republic of	2004	3.81	4.98
Indonesia	1970	4.10	5.34	Cote d'Ivoire	1975	4.26	2.91
Indonesia	1990	7.69	2.66	Djibouti	1988	4.01	3.51
Indonesia	2005	3.73	2.19	Djibouti	2002	4.53	4.69
Japan	1961	9.56	2.11	Egypt	1970	3.55	2.76
Japan	1972	13.44	2.02	Egypt	1995	3.88	2.01
Japan	1987	10.76	2.07	Equatorial Guinea	1990	23.40	23.73
Korea, Republic of	1962	7.00	7.64	Ethiopia	2007	8.90	8.26
Korea, Republic of	1972	12.60	2.02	Gabon	1974	7.01	3.01
Korea, Republic of	1988	11.09	2.28	Guinea	2002	5.53	4.48
Laos	1988	4.88	6.00	Israel	1970	6.69	2.32
Laos	2001	7.78	3.00	Iran	1965	7.49	2.09
Macao	1971	6.37	3.36	Iran	1971	9.97	2.03
Macao	1991	5.88	2.46	Iraq	1978	5.67	3.79
Macao	2003	10.97	9.67	Jordan	1976	9.05	4.72
Malaysia	1966	4.16	3.43	Kuwait	1988	4.75	5.02
Malaysia	1992	7.40	3.55	Lesotho	1969	4.05	4.18
Maldives	1977	9.08	10.62	Lesotho	1990	6.67	3.09
Maldives	2000	9.83	2.79	Malawi	1973	10.75	3.44
Myanmar	1971	3.73	2.70	Malta	1963	4.87	2.13
Myanmar	1978	6.57	2.85	Morocco	1970	4.39	4.28
Myanmar	2001	13.94	4.90	Mauritania	1971	5.90	2.07
Nepal	1970	4.32	3.83	Mauritania	2007	7.63	2.14
Philippines	1977	5.17	2.15	Mauritius	1972	3.51	4.47
Singapore	1971	8.14	2.19	Mauritius	1984	4.04	2.56
Singapore	1992	6.03	2.21	Mozambique	1998	4.39	3.12
Sri Lanka	1975	4.73	2.37	Mozambique	2005	6.86	2.47
Sri Lanka	2005	5.12	2.19	Namibia	1967	3.64	2.17
Taiwan	1960	4.23	4.60	Namibia	2004	5.75	3.17
Taiwan	1988	8.74	2.05	Nigeria	1974	8.87	2.78
Thailand	1959	3.85	4.95	Nigeria	2007	3.85	2.53
Thailand	1984	7.05	2.16	Oman	2002	5.14	2.17
Turkey	1964	3.86	2.85	Rwanda	2004	6.98	7.21
Turkey	1983	4.01	2.26	Sao Tome and Principe	1989	4.00	4.74
Turkey	2003	4.36	2.19	Seychelles	1965	4.74	6.08
Turkmenistan	2007	9.49	8.99	Seychelles	2007	3.56	2.37
Uzbekistan	2007	4.47	2.66	Sudan	1993	10.68	11.66
Vietnam	1990	8.92	7.00	Swaziland	1974	9.89	2.79

Table 3: List of Episodes (cont.)

Country	Year	K/L Growth	Acceleration	Country	Year	K/L Growth	Acceleration
Syria	1976	4.61	2.65	Haiti	1998	3.76	2.23
Tanzania	1968	4.41	2.63	Jamaica	1966	3.58	2.23
Tanzania	2007	5.17	3.72	Nicaragua	1964	3.52	2.61
Togo	1975	4.99	3.90	Panama	1963	3.64	2.95
Tunisia	1974	5.10	2.01	Panama	1994	3.75	3.75
Uganda	1962	5.32	2.90	Panama	2007	8.11	5.92
Uganda	1995	4.01	2.27	Paraguay	1969	3.89	3.15
Uganda	2003	7.27	3.27	Peru	1993	3.80	4.29
Yemen	1993	4.44	6.21	Peru	2004	4.75	2.72
Yemen	2003	5.22	2.02	St. Kitts & Nevis	1987	7.23	2.30
Latin America & The Caribbean				Suriname	1972	6.40	2.43
Antigua and Barbuda	1980	4.13	2.74	Suriname	1999	3.75	2.39
Antigua and Barbuda	2001	5.11	2.11	Trinidad & Tobago	1976	7.39	2.11
Argentina	1968	3.80	2.51	Turks and Caicos Islands	2002	12.47	8.14
Bahamas	1978	3.55	4.34	Uruguay	1972	3.83	2.38
Bahamas	1994	5.04	2.89	Venezuela	1974	5.64	2.06
Barbados	1966	4.94	2.82	Europe			
Barbados	1987	4.65	2.11	Albania	2001	7.70	4.85
Barbados	1994	7.12	2.47	Austria	1969	5.98	2.05
Belize	1986	4.27	5.95	Belarus	2004	7.26	5.48
Bolivia	2006	3.65	3.39	Bosnia and Herzegovina	1996	12.38	4.52
Brazil	1965	3.77	3.78	Bulgaria	1999	9.83	6.69
Cayman Islands	1976	3.58	3.38	Cyprus	1964	4.42	2.23
Chile	1965	5.08	2.17	Cyprus	1971	6.55	2.13
Chile	1991	6.65	3.78	Denmark	1959	5.41	2.20
Colombia	2006	3.64	2.50	Estonia	1998	4.68	2.17
Costa Rica	1967	3.77	2.27	Greece	1964	7.99	3.14
Dominica	1980	4.65	2.03	Ireland	1994	4.87	2.49
Dominica	2003	3.60	2.24	Latvia	1999	3.62	2.63
Dominican Republic	1967	4.97	5.50	Lithuania	2001	4.93	2.12
Dominican Republic	1992	5.80	2.54	Montenegro	2002	4.69	3.59
Ecuador	1972	3.53	2.24	Poland	1995	4.90	2.83
El Salvador	1971	3.98	4.56	Portugal	1959	4.94	2.07
El Salvador	1990	3.53	3.09	Romania	1975	9.61	2.50
Grenada	1979	9.09	3.59	Romania	2000	3.89	2.26
Haiti	1970	4.16	5.61	Spain	1963	7.13	2.61

Table 4: Unconditional Probabilities by Region and Income

Decade	1950s	1960s	1970s	1980s	1990s	2000s	Total
East Asia and Pacific	0.0167	0.0309	0.0621	0.0292	0.0640	0.0294	0.0401
Latin-American & Caribbean	0.0000	0.0323	0.0395	0.0169	0.0283	0.0302	0.0271
Middle East & North Africa	0.0000	0.0118	0.0511	0.0123	0.0127	0.0238	0.0198
South Asia & Central Asia	0.0000	0.0069	0.0222	0.0233	0.0073	0.0941	0.0237
Sub-Saharan Africa	0.0000	0.0190	0.0333	0.0097	0.0121	0.0365	0.0198
Europe & North America	0.0159	0.0100	0.0025	0.0000	0.0144	0.0174	0.0087
1st Quintile	0.0227	0.0217	0.0346	0.0096	0.0270	0.0383	0.0249
2nd Quintile	0.0000	0.0270	0.0510	0.0261	0.0236	0.0395	0.0318
3rd Quintile	0.0200	0.0786	0.0324	0.0157	0.0196	0.0558	0.0343
4th Quintile	0.0192	0.0158	0.0471	0.0197	0.0238	0.0395	0.0284
5th Quintile	0.0000	0.0227	0.0046	0.0064	0.0138	0.0079	0.0091
Total	0.0054	0.0179	0.0286	0.0126	0.0208	0.0324	0.0207

Table 5: Variable Descriptions

	Description	Source
POLICY VARIABLES		
Underval	Undervaluation index	PWT 9.0
Capital_Output	Natural log of capital to output ratio	PWT 9.0
Fiscal	5 year corr. of GDP and gov. cons. (dev. from trends)	WDI
Inflation	Rate of inflation	WDI
XR_Stability	Exchange rate stability index	Aizenman et. al. (2013)
INTERNAL VARIABLES		
Crisis_5y	Dummy for a crisis episode (previous 5 years)	Laeven and Valencia (2012)
Rents	Share or natural resource rent on GDP	WDI
Capita_GDP	Natural log of per capita GDP	PWT 9.0
EXTERNAL VARIABLES		
NET_Inflows	Net capital Inflows / Trend GDP (5 year avg.)	Broner et. al. (2013)
FF_Rate	Federal Funds Rate (end of period)	FRED
Global_Uncertainty	Volatility of US stock market index	FRED
TOT	Log of terms of trade	Spatafor and Tytell (2009)
Trade	(Imports + exports) / GDP	PWT 9.0
KA_Open	Capital account openness index	Aizenman et. al. (2013)
INSTITUTIONAL VARIABLES		
Human_Capital	Years of education adjusted by the return of schooling	PWT 9.0
Durable	Political Regime Durability (years)	Polity IV

Table 6: Summary Statistics and Expected Signs

	Observations	Mean	SD	Max / Min	Exp. Sign
POLICY VARIABLES					
Underval	9439	0.0000	0.4125	-2.1440 / 2.6272	+
Capital_Output	9409	1.0728	0.5588	-1.4499 / 3.3375	-
Fiscal	4609	0.3498	0.5085	1 / -1	-
Inflation	5852	0.3192	3.9813	237.73 / -0.1764	+/-
XR_Stability	7333	0.6939	0.3282	1 / 0.0013	+/-
INTERNAL VARIABLES					
Crisis_5y	12787	0.0836	0.2768	1 / 0	-
Rents	6591	10.0348	14.3107	89.3287 / 0	+/-
Capita_GDP	9439	8.7462	1.2244	5.0851 / 12.3825	+
EXTERNAL VARIABLES					
NET_Inflows	2632	-0.0786	1.6029	-37.4856 / 7.2120	+/-
FF_Rate	9686	5.2991	3.3649	16.38 / 0.1	-
Global_Uncertainty	5678	20.2568	6.4431	40.82 / 9.8	-
TOT	3493	4.6615	0.2871	5.8793 / 3.0576	+/-
Trade	6767	0.7675	0.5010	5.6206 / 0.0531	+/-
KA_Open	5595	0.0000	1.5244	0.24390 / -1.8640	+/-
INSTITUTIONAL VARIABLES					
Human_Capital	7867	0.6473	0.3553	0.0070 / 1.3176	+
Durable	7499	22.1756	28.9124	202 / 0	+/-

Table 7: Baseline Probits - Average Marginal Effects

Dependent Variable: Episode Dummy					
Model	(1) Probit	(2) Probit	(3) Probit	(4) Probit	(5) Probit
Underval	0.012* (0.006)	0.041*** (0.013)	0.080*** (0.025)	0.041 (0.027)	0.052* (0.028)
Capital_Output	-0.058*** (0.006)	-0.079*** (0.010)	-0.147*** (0.025)	-0.100*** (0.026)	-0.092*** (0.026)
Fiscal		0.015 (0.009)	0.011 (0.017)	0.004 (0.018)	-0.000 (0.018)
Inflation		-0.058** (0.026)	-0.060 (0.048)	-0.071 (0.046)	-0.079* (0.047)
XR_Stability		0.019 (0.015)	-0.018 (0.030)	-0.043 (0.030)	-0.050* (0.030)
Crisis_5y			-0.027 (0.018)	-0.024 (0.017)	-0.019 (0.018)
Rents			-0.000 (0.001)	-0.002** (0.001)	-0.002** (0.001)
Trade			0.003 (0.022)	-0.014 (0.024)	-0.037 (0.028)
KA_Open			0.003 (0.006)	0.006 (0.007)	0.007 (0.007)
NET_Inflows			-0.337* (0.174)	-0.796*** (0.198)	
FDI_Inflows					-0.002 (0.004)
Port_Inflows					-0.009*** (0.002)
Reserves					0.011** (0.004)
TOT			-0.049 (0.044)	0.004 (0.047)	0.006 (0.048)
FF_Rate			-0.002 (0.003)	0.000 (0.003)	0.001 (0.003)
Global_Uncertainty			-0.002 (0.002)	-0.003 (0.002)	-0.003 (0.002)
Human_Capital				0.137*** (0.053)	0.132** (0.054)
Capita_GDP				-0.071*** (0.019)	-0.068*** (0.020)
Durable				-0.001*** (0.000)	-0.002*** (0.000)
R-squared	0.033	0.065	0.126	0.167	0.183
Observations	6,791	3,117	999	967	951

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 8: Manufacturing vs. Non-Manufacturing Countries - Average Marginal Effects

Dependent Variable: Episode Dummy										
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit
	Manufacturing Only					Non-Manufacturing Only				
Underval	0.022 (0.014)	0.055*** (0.019)	0.115*** (0.035)	0.057 (0.040)	0.055 (0.040)	0.001 (0.009)	0.010 (0.018)	-0.076 (0.050)	-0.157*** (0.056)	-0.123** (0.058)
Capital_Output	-0.078*** (0.012)	-0.113*** (0.016)	-0.145*** (0.035)	-0.119*** (0.037)	-0.124*** (0.038)	-0.052*** (0.007)	-0.069*** (0.013)	-0.256*** (0.054)	-0.201*** (0.052)	-0.171*** (0.057)
Fiscal		0.020 (0.013)	0.012 (0.024)	0.009 (0.026)	0.005 (0.027)		0.007 (0.014)	0.081** (0.041)	0.063* (0.032)	0.038 (0.032)
Inflation		-0.100** (0.048)	-0.083 (0.062)	-0.038 (0.061)	-0.044 (0.063)		-0.022 (0.024)	-0.003 (0.023)	-0.094** (0.047)	-0.075* (0.041)
XR_Stability		0.022 (0.022)	-0.027 (0.039)	-0.037 (0.041)	-0.044 (0.042)		0.032 (0.021)	-0.059 (0.050)	-0.141*** (0.047)	-0.118** (0.048)
Crisis_5y			0.015 (0.024)	0.015 (0.023)	0.015 (0.023)			-0.096*** (0.031)	-0.098*** (0.025)	-0.069** (0.028)
Rents			-0.000 (0.003)	0.000 (0.003)	0.001 (0.003)			-0.000 (0.001)	-0.002*** (0.001)	-0.002** (0.001)
Trade			-0.036 (0.031)	-0.059 (0.037)	-0.056 (0.046)			0.110*** (0.042)	0.065* (0.034)	0.018 (0.036)
KA_Open			0.011 (0.010)	0.014 (0.011)	0.013 (0.011)			0.009 (0.009)	0.019* (0.010)	0.021** (0.010)
NET_Inflows			-0.163 (0.314)	-0.663* (0.352)				-0.500** (0.226)	-1.108*** (0.237)	
FDI_Inflows					-0.005 (0.008)					0.002 (0.005)
Port_Inflows					-0.009** (0.003)					-0.010*** (0.002)
Reserves					0.004 (0.008)					0.016*** (0.004)
TOT			0.002 (0.066)	-0.013 (0.065)	-0.007 (0.066)			-0.053 (0.063)	0.058 (0.066)	0.095 (0.072)
FF_Rate			0.002 (0.004)	0.004 (0.004)	0.004 (0.004)			-0.013** (0.005)	-0.016*** (0.006)	-0.016*** (0.006)
Global_Uncertainty			0.001 (0.003)	0.001 (0.002)	0.000 (0.003)			-0.010** (0.004)	-0.020*** (0.004)	-0.017*** (0.004)
Human_Capital				0.204*** (0.075)	0.217*** (0.077)				0.033 (0.085)	0.037 (0.081)
Capita_GDP				-0.072** (0.030)	-0.077** (0.030)				-0.116*** (0.038)	-0.104*** (0.037)
Durable				-0.002*** (0.001)	-0.002*** (0.001)				-0.001 (0.001)	-0.001 (0.001)
R-squared	0.043	0.095	0.125	0.165	0.173	0.032	0.058	0.341	0.525	0.574
Observations	2,595	1,631	609	593	584	4,196	1,486	390	374	367

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9: Construction vs. Machinery and Equipment - Average Marginal Effects

Dependent Variable: Episode Dummy										
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit
	Construction Booms Only					Machinery and Equipment Booms Only				
Underval	0.007 (0.006)	0.016 (0.011)	0.057*** (0.022)	-0.002 (0.024)	0.001 (0.024)	0.031*** (0.009)	0.099*** (0.017)	0.184*** (0.034)	0.217*** (0.038)	0.216*** (0.039)
Capital_Output	-0.046*** (0.005)	-0.055*** (0.008)	-0.082*** (0.021)	-0.036 (0.023)	-0.032 (0.023)	-0.023*** (0.007)	-0.031** (0.012)	-0.055* (0.028)	-0.068** (0.029)	-0.072** (0.030)
Fiscal		-0.015* (0.008)	-0.007 (0.015)	-0.024 (0.016)	-0.024 (0.016)		-0.002 (0.012)	0.022 (0.023)	0.029 (0.024)	0.031 (0.025)
Inflation		-0.017 (0.013)	-0.001 (0.005)	-0.002 (0.005)	-0.002 (0.004)		-0.001 (0.002)	-0.000 (0.002)	-0.000 (0.002)	-0.000 (0.002)
XR_Stability		0.007 (0.013)	-0.012 (0.027)	-0.029 (0.027)	-0.030 (0.028)		-0.000 (0.019)	-0.054 (0.036)	-0.040 (0.037)	-0.044 (0.037)
Crisis_5y			-0.068*** (0.019)	-0.061*** (0.018)	-0.057*** (0.018)			-0.006 (0.022)	-0.011 (0.022)	-0.010 (0.022)
Rents			0.000 (0.001)	-0.001 (0.001)	-0.001 (0.001)			-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
Trade			0.025 (0.018)	0.036* (0.021)	0.029 (0.024)			-0.020 (0.025)	-0.084*** (0.030)	-0.076** (0.035)
KA_Open			0.000 (0.006)	0.004 (0.006)	0.004 (0.006)			-0.009 (0.008)	-0.015* (0.009)	-0.017* (0.009)
NET_Inflows			-0.192 (0.141)	-0.411** (0.162)				-0.853*** (0.235)	-0.823*** (0.249)	
FDI_Inflows					-0.002 (0.004)					-0.006 (0.006)
Port_Inflows					-0.004** (0.002)					-0.008*** (0.002)
Reserves					0.007** (0.003)					0.005 (0.005)
TOT			-0.042 (0.040)	0.038 (0.049)	0.039 (0.049)			-0.127** (0.061)	-0.163*** (0.061)	-0.166*** (0.062)
FF_Rate			-0.003 (0.003)	-0.002 (0.003)	-0.002 (0.003)			-0.006* (0.004)	-0.003 (0.004)	-0.003 (0.004)
Global_Uncertainty			-0.002 (0.002)	-0.001 (0.002)	-0.001 (0.002)			0.003 (0.002)	0.002 (0.002)	0.002 (0.002)
Human_Capital				0.192*** (0.053)	0.188*** (0.053)				0.118* (0.064)	0.120* (0.064)
Capita_GDP				-0.105*** (0.020)	-0.104*** (0.020)				0.008 (0.023)	0.008 (0.023)
Durable				-0.000 (0.000)	-0.000 (0.000)				0.000 (0.000)	0.000 (0.000)
R-squared	0.030	0.041	0.100	0.164	0.167	0.006	0.019	0.099	0.126	0.127
Observations	7,307	3,382	1,087	1,045	1,028	6,963	3,169	1,023	990	974

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10: Robustness OLS

Dependent Variable: Episode Dummy					
Model	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
Underval	0.012*	0.032**	0.088**	0.038	0.043
	(0.006)	(0.014)	(0.034)	(0.039)	(0.039)
Capital_Output	-0.063***	-0.090***	-0.156***	-0.088***	-0.084***
	(0.007)	(0.014)	(0.030)	(0.029)	(0.029)
Fiscal		0.012	0.010	0.007	0.009
		(0.009)	(0.018)	(0.019)	(0.019)
Inflation		-0.001***	-0.001	-0.002***	-0.002***
		(0.000)	(0.001)	(0.001)	(0.001)
XR_Stability		0.034**	0.014	-0.003	-0.002
		(0.014)	(0.028)	(0.029)	(0.029)
Crisis_5y			-0.037**	-0.032*	-0.029
			(0.018)	(0.018)	(0.019)
Rents			0.000	-0.001	-0.001
			(0.001)	(0.001)	(0.001)
Trade			0.010	-0.004	-0.012
			(0.023)	(0.028)	(0.029)
KA_Open			0.005	0.010	0.010
			(0.008)	(0.009)	(0.009)
NET_Inflows			-0.215	-0.717***	
			(0.240)	(0.216)	
FDI_Inflows					-0.003
					(0.004)
Port_Inflows					-0.008***
					(0.002)
Reserves					0.008
					(0.005)
TOT			-0.056	0.010	0.011
			(0.041)	(0.035)	(0.035)
FF_Rate			-0.003	-0.001	-0.000
			(0.003)	(0.003)	(0.003)
Global_Uncertainty			-0.002	-0.003	-0.003
			(0.002)	(0.002)	(0.002)
Human_Capital				0.117**	0.112**
				(0.053)	(0.053)
Capita_GDP				-0.059***	-0.054**
				(0.021)	(0.022)
Durable				-0.001***	-0.001***
				(0.000)	(0.000)
Constant	0.143***	0.144***	0.559***	0.670***	0.631***
	(0.009)	(0.020)	(0.205)	(0.194)	(0.196)
Observations	6,791	3,117	999	967	951
R-squared	0.019	0.032	0.067	0.068	0.075

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11: 5 and 9 years Probits - Average Marginal Effects

Dependent Variable: Episode Dummy										
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit
	5 Years Long Filter					9 Years Long Filter				
Underval	0.009 (0.007)	0.047*** (0.014)	0.105*** (0.026)	0.085*** (0.029)	0.096*** (0.030)	0.020*** (0.006)	0.060*** (0.014)	0.084*** (0.025)	0.043 (0.028)	0.051* (0.029)
Capital_Output	-0.072*** (0.006)	-0.104*** (0.011)	-0.166*** (0.025)	-0.123*** (0.026)	-0.124*** (0.027)	-0.047*** (0.005)	-0.059*** (0.009)	-0.117*** (0.023)	-0.073*** (0.025)	-0.066*** (0.025)
Fiscal		0.020* (0.010)	0.019 (0.018)	0.011 (0.019)	0.011 (0.020)		0.020** (0.009)	0.033* (0.018)	0.032* (0.019)	0.019 (0.018)
Inflation		-0.059** (0.026)	-0.062 (0.052)	-0.058 (0.047)	-0.065 (0.049)		-0.075** (0.030)	-0.079 (0.062)	-0.064 (0.058)	-0.078 (0.060)
XR_Stability		0.026 (0.017)	-0.004 (0.031)	-0.013 (0.031)	-0.021 (0.032)		0.040*** (0.015)	0.032 (0.030)	0.011 (0.030)	-0.003 (0.030)
Crisis_5y			-0.040** (0.019)	-0.037** (0.018)	-0.037** (0.019)			-0.057*** (0.019)	-0.053*** (0.018)	-0.049*** (0.019)
Rents			-0.001* (0.001)	-0.003*** (0.001)	-0.003*** (0.001)			-0.001 (0.001)	-0.001* (0.001)	-0.002** (0.001)
Trade			0.039* (0.021)	0.029 (0.024)	0.027 (0.028)			0.034* (0.020)	0.032 (0.023)	0.001 (0.027)
KA_Open			0.003 (0.007)	0.006 (0.007)	0.006 (0.007)			-0.008 (0.006)	0.000 (0.007)	0.001 (0.007)
NET_Inflows			-0.205 (0.179)	-0.624*** (0.206)				-0.230 (0.171)	-0.623*** (0.194)	
FDI_Inflows					-0.002 (0.005)					0.003 (0.004)
Port_Inflows					-0.007*** (0.002)					-0.008*** (0.002)
Reserves					0.004 (0.005)					0.002 (0.004)
TOT			0.000 (0.047)	0.060 (0.053)	0.060 (0.053)			-0.070 (0.044)	-0.002 (0.048)	0.001 (0.048)
FF_Rate			-0.001 (0.003)	-0.002 (0.003)	-0.001 (0.003)			0.000 (0.003)	0.001 (0.003)	0.002 (0.003)
Global_Uncertainty			-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)			-0.001 (0.002)	-0.002 (0.002)	-0.002 (0.002)
Human_Capital				0.084 (0.053)	0.076 (0.054)				0.106** (0.052)	0.103** (0.052)
Capita_GDP				-0.050** (0.020)	-0.044** (0.021)				-0.074*** (0.020)	-0.072*** (0.020)
Durable				-0.001*** (0.001)	-0.002*** (0.001)				-0.001 (0.000)	-0.001* (0.000)
R-squared	0.039	0.081	0.161	0.185	0.194	0.029	0.063	0.137	0.160	0.176
Observations	6,645	3,036	970	940	924	6,878	3,165	1,000	971	955

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 12: Stricter Filter Probits - Average Marginal Effects

Dependent Variable: Episode Dummy										
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit	Probit
	Stricter Filter ⁺					Strictest Filter ⁺⁺				
Underval	0.005 (0.005)	0.032*** (0.010)	0.064*** (0.020)	0.044* (0.023)	0.067** (0.026)	0.003 (0.003)	0.007 (0.006)	0.032** (0.014)	0.056** (0.023)	0.073** (0.029)
Capital_Output	-0.044*** (0.004)	-0.045*** (0.007)	-0.062*** (0.017)	-0.035** (0.018)	-0.018 (0.018)	-0.019*** (0.003)	-0.026*** (0.005)	-0.049*** (0.013)	-0.022*** (0.008)	-0.028*** (0.010)
Fiscal		0.001 (0.007)	-0.002 (0.012)	-0.001 (0.013)	-0.003 (0.013)		0.011** (0.005)	0.007 (0.007)	0.031** (0.012)	0.041** (0.016)
Inflation		-0.019 (0.015)	-0.183** (0.086)	-0.185** (0.090)	-0.189** (0.091)		-0.008 (0.009)	-0.028 (0.039)	-0.123 (0.093)	-0.237* (0.142)
XR_Stability		0.023** (0.011)	0.003 (0.021)	-0.012 (0.021)	-0.015 (0.022)		0.002 (0.007)	-0.007 (0.012)	-0.031** (0.013)	-0.038*** (0.014)
Crisis_5y			-0.012 (0.013)	-0.013 (0.012)	-0.011 (0.012)			-0.021* (0.011)	-0.013** (0.007)	-0.023* (0.014)
Rents			-0.000 (0.001)	-0.001 (0.001)	-0.001* (0.001)			-0.000 (0.000)	-0.001* (0.001)	-0.001* (0.001)
Trade			0.031** (0.014)	0.022 (0.016)	-0.008 (0.018)			0.034*** (0.010)	0.030*** (0.011)	0.031*** (0.011)
KA_Open			-0.009** (0.004)	-0.004 (0.005)	-0.003 (0.005)			-0.001 (0.002)	0.009** (0.004)	0.006* (0.003)
NET_Inflows			0.277** (0.122)	-0.043 (0.134)				0.176** (0.076)	-0.158* (0.090)	
FDI_Inflows					0.006* (0.003)					-0.000 (0.002)
Port_Inflows					-0.003** (0.001)					-0.001 (0.001)
Reserves					0.007** (0.003)					0.004*** (0.001)
TOT			-0.014 (0.033)	0.030 (0.038)	0.047 (0.041)			0.006 (0.016)	0.089** (0.037)	0.092*** (0.034)
FF_Rate			-0.005** (0.002)	-0.003 (0.002)	-0.002 (0.002)			0.001 (0.001)	0.003** (0.001)	0.003** (0.001)
Global_Uncertainty			-0.002 (0.001)	-0.002 (0.001)	-0.002 (0.001)			0.002* (0.001)	0.001* (0.001)	0.001 (0.001)
Human_Capital				0.078** (0.035)	0.076** (0.036)				-0.000 (0.018)	-0.012 (0.023)
Capita_GDP				-0.040*** (0.015)	-0.040*** (0.015)				-0.004 (0.010)	0.008 (0.013)
Durable				-0.001* (0.000)	-0.001** (0.000)				-0.000 (0.000)	-0.000 (0.000)
R-squared	0.048	0.070	0.193	0.195	0.236	0.050	0.121	0.473	0.721	0.789
Observations	7,162	3,325	1,072	1,039	1,023	7,484	3,453	1,110	1,074	1,057

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

+ Capital stock per capita growth \geq 5%, accelerates \geq 3%, and capital stock per capita at the end \geq pre-episode peak.+ Capital stock per capita growth \geq 7%, accelerates \geq 4%, and capital stock per capita at the end \geq pre-episode peak.

Table 13: Probits with 5 Years Averages - Average Marginal Effects

Dependent Variable: Episode Dummy					
Model	(1) Probit	(2) Probit	(3) Probit	(4) Probit	(5) Probit
Underval5yrs	0.018** (0.008)	0.076*** (0.015)	0.063* (0.034)	0.005 (0.038)	0.008 (0.039)
Capital_Output5yrs	-0.061*** (0.006)	-0.074*** (0.010)	-0.133*** (0.030)	-0.115*** (0.033)	-0.110*** (0.034)
Fiscal5yrs		-0.003 (0.011)	-0.005 (0.024)	-0.015 (0.025)	-0.013 (0.026)
Inflation5yrs		0.000 (0.001)	0.003 (0.003)	-0.001 (0.003)	-0.001 (0.003)
XR_Stability5yrs		0.013 (0.018)	-0.056 (0.045)	-0.106** (0.049)	-0.106** (0.050)
Crisis_5y			-0.044** (0.022)	-0.033 (0.021)	-0.031 (0.021)
Rents5yrs			0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
Trade5yrs			0.020 (0.027)	0.017 (0.030)	0.013 (0.036)
KA_Open5yrs			0.004 (0.008)	0.009 (0.008)	0.009 (0.008)
NET_Inflows			-0.483** (0.240)	-0.801*** (0.250)	
FDI_Inflows					-0.005 (0.006)
Port_Inflows					-0.008*** (0.003)
Reserves					0.010** (0.005)
TOT5yrs			-0.082 (0.052)	-0.036 (0.057)	-0.033 (0.057)
FF_Rate5yrs			0.011* (0.006)	0.010* (0.006)	0.010* (0.006)
Global_Uncertainty5yrs			0.005 (0.005)	0.004 (0.005)	0.004 (0.005)
Human_Capital5yrs				0.130* (0.069)	0.123* (0.070)
Capita_GDP5yrs				-0.097*** (0.025)	-0.095*** (0.026)
Durable5yrs				-0.001 (0.001)	-0.001* (0.001)
Pseudo R-squared	0.035	0.069	0.121	0.162	0.165
Observations	6,344	2,670	722	709	700

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 14: Long Lasting Probits (13 years window) - Average Marginal Effects

Dependent Variable: Episode Dummy					
Model	(1) Probit	(2) Probit	(3) Probit	(4) Probit	(5) Probit
Underval	0.012** (0.005)	0.042*** (0.012)	0.064*** (0.021)	0.029 (0.022)	0.033 (0.023)
Capital_Output	-0.042*** (0.005)	-0.058*** (0.008)	-0.114*** (0.021)	-0.081*** (0.021)	-0.086*** (0.022)
Fiscal		-0.004 (0.008)	-0.020 (0.014)	-0.011 (0.014)	-0.010 (0.015)
Inflation		-0.032 (0.020)	-0.087 (0.054)	-0.097 (0.069)	-0.107 (0.072)
XR_Stability		0.024* (0.014)	0.023 (0.024)	0.011 (0.024)	0.010 (0.024)
Crisis_5y			-0.007 (0.015)	-0.005 (0.015)	-0.005 (0.015)
Rents			-0.000 (0.001)	-0.000 (0.001)	-0.000 (0.001)
Trade			0.009 (0.017)	0.007 (0.019)	0.014 (0.023)
KA_Open			-0.002 (0.005)	0.007 (0.006)	0.006 (0.006)
NET_Inflows			-0.043 (0.131)	-0.268* (0.150)	
FDI_Inflows					-0.002 (0.003)
Port_Inflows					-0.003* (0.002)
Reserves					0.000 (0.004)
TOT			-0.069* (0.036)	-0.017 (0.038)	-0.017 (0.039)
FF_Rate			0.002 (0.002)	0.003 (0.002)	0.002 (0.003)
Global_Uncertainty			0.005*** (0.002)	0.004*** (0.002)	0.004*** (0.002)
Human_Capital				0.013 (0.043)	0.009 (0.044)
Capita_GDP				-0.042*** (0.015)	-0.040*** (0.016)
Durable				0.000 (0.000)	0.000 (0.000)
Pseudo R-squared	0.032	0.058	0.190	0.176	0.178
Observations	6,983	3,204	1,021	991	975

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 15: Sustained Probits⁺ - Average Marginal Effects

Dependent Variable: Episode Dummy					
Model	(1) Probit	(2) Probit	(3) Probit	(4) Probit	(5) Probit
Underval	0.011** (0.005)	0.024** (0.010)	0.078*** (0.022)	0.032 (0.022)	0.044* (0.024)
Capital_Output	-0.024*** (0.004)	-0.038*** (0.007)	-0.086*** (0.019)	-0.042** (0.019)	-0.039** (0.020)
Fiscal		0.010 (0.007)	-0.001 (0.014)	-0.021 (0.015)	-0.023 (0.015)
Inflation		-0.061** (0.026)	-0.001 (0.013)	-0.011 (0.021)	-0.013 (0.023)
XR_Stability		0.003 (0.011)	0.015 (0.024)	0.000 (0.024)	-0.010 (0.024)
Crisis_5y			-0.038** (0.016)	-0.033** (0.014)	-0.032** (0.014)
Rents			0.000 (0.000)	-0.001* (0.001)	-0.001* (0.001)
Trade			-0.016 (0.018)	-0.051** (0.021)	-0.063*** (0.024)
KA_Open			0.005 (0.005)	0.004 (0.005)	0.004 (0.005)
NET_Inflows			-0.210 (0.130)	-0.608*** (0.153)	
FDI_Inflows					-0.002 (0.003)
Port_Inflows					-0.007*** (0.001)
Reserves					0.005 (0.004)
TOT			0.047 (0.045)	0.117** (0.050)	0.121** (0.051)
FF_Rate			-0.010*** (0.003)	-0.009*** (0.003)	-0.008*** (0.003)
Global_Uncertainty			0.002 (0.002)	0.001 (0.002)	0.001 (0.002)
Human_Capital				0.186*** (0.047)	0.175*** (0.048)
Capita_GDP				-0.075*** (0.017)	-0.072*** (0.017)
Durable				-0.001* (0.000)	-0.001* (0.000)
Pseudo R-squared	0.023	0.060	0.226	0.304	0.326
Observations	6,791	3,117	999	967	951

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

+ original criteria and growth is ≥ 3.5 (p.p.) in the following 8-year window.

Figure 1: Episodes in Botswana

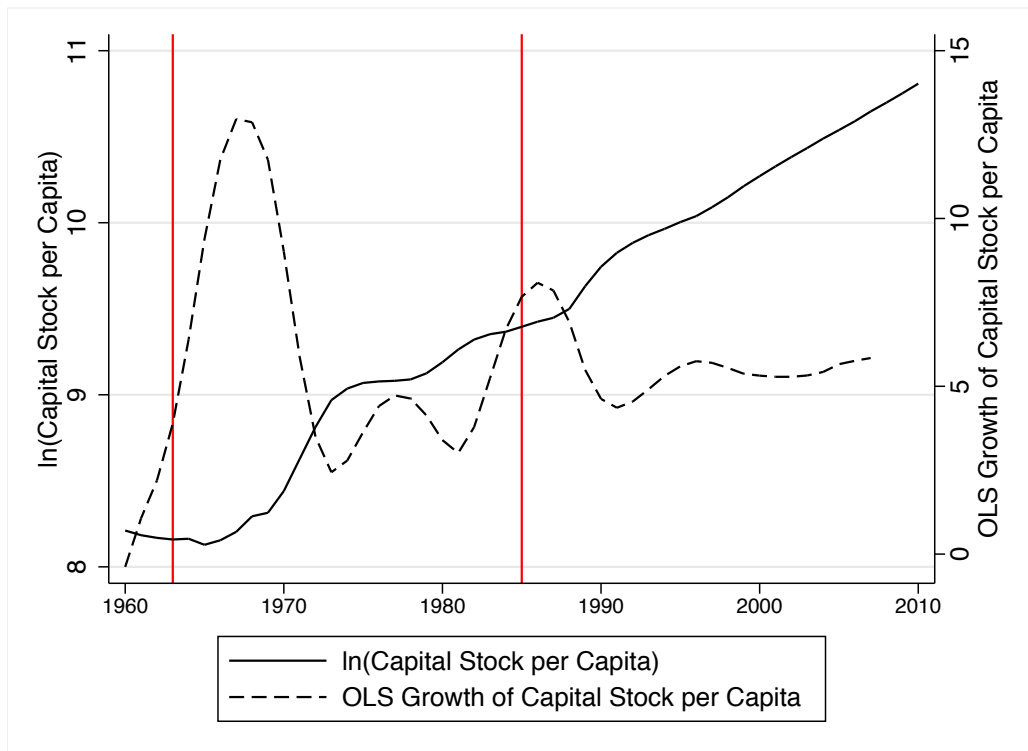


Figure 2: Shares of Value Added and Employment During Episodes

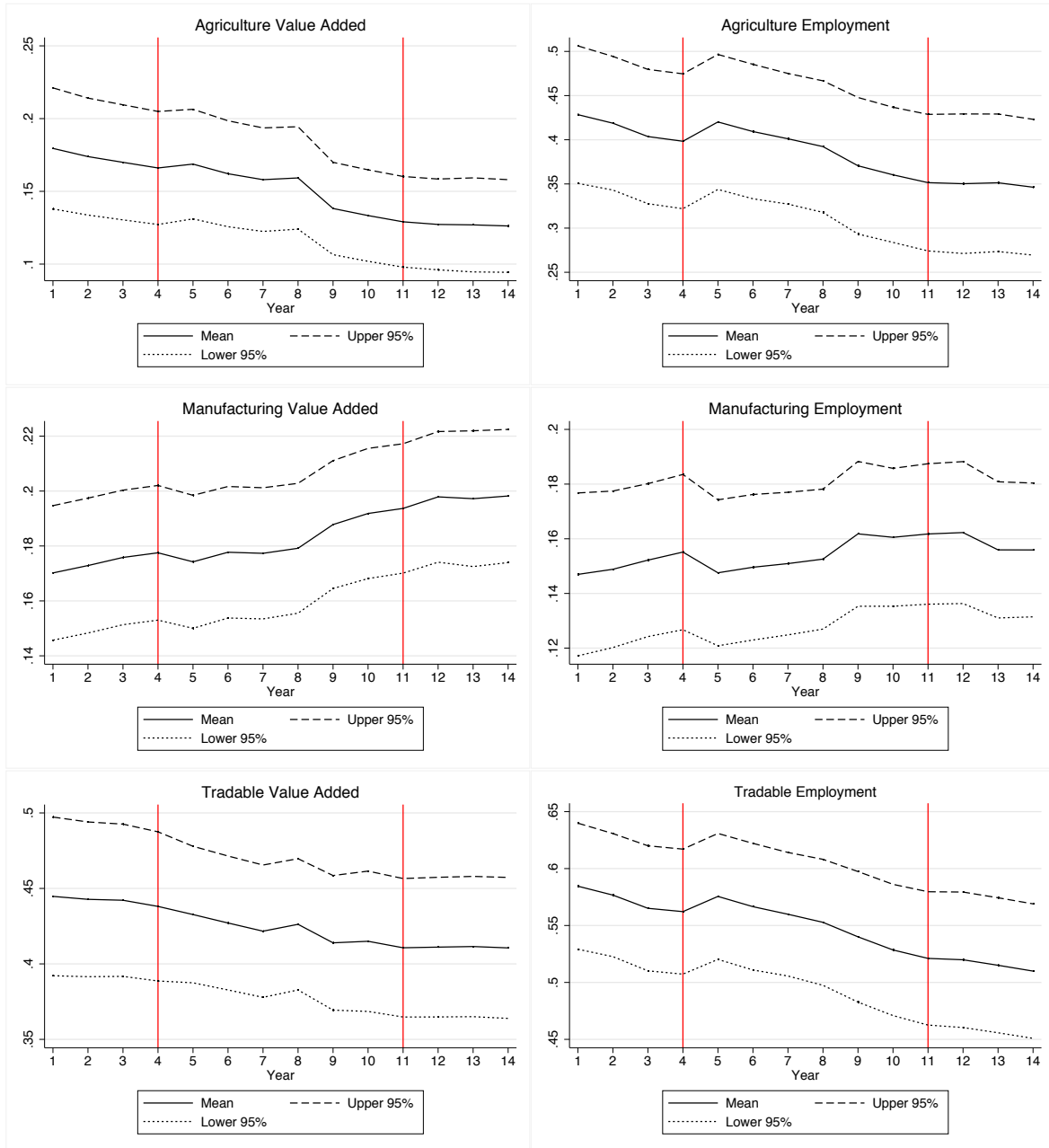


Figure 3: Shares of Value Added and Employment in Agriculture During Episodes by Region

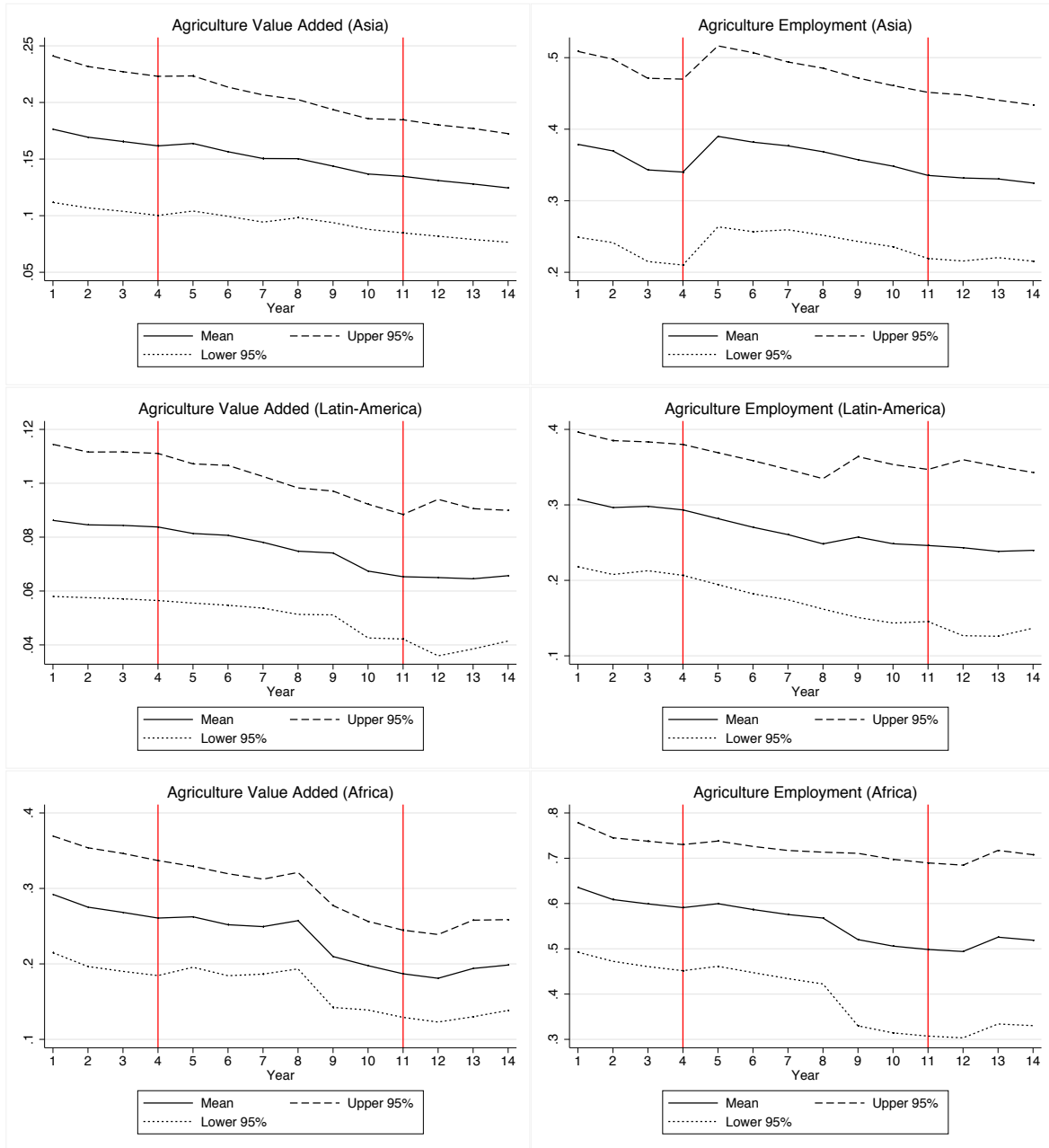


Figure 4: Shares of Value Added and Employment in Manufactures During Episodes by Region

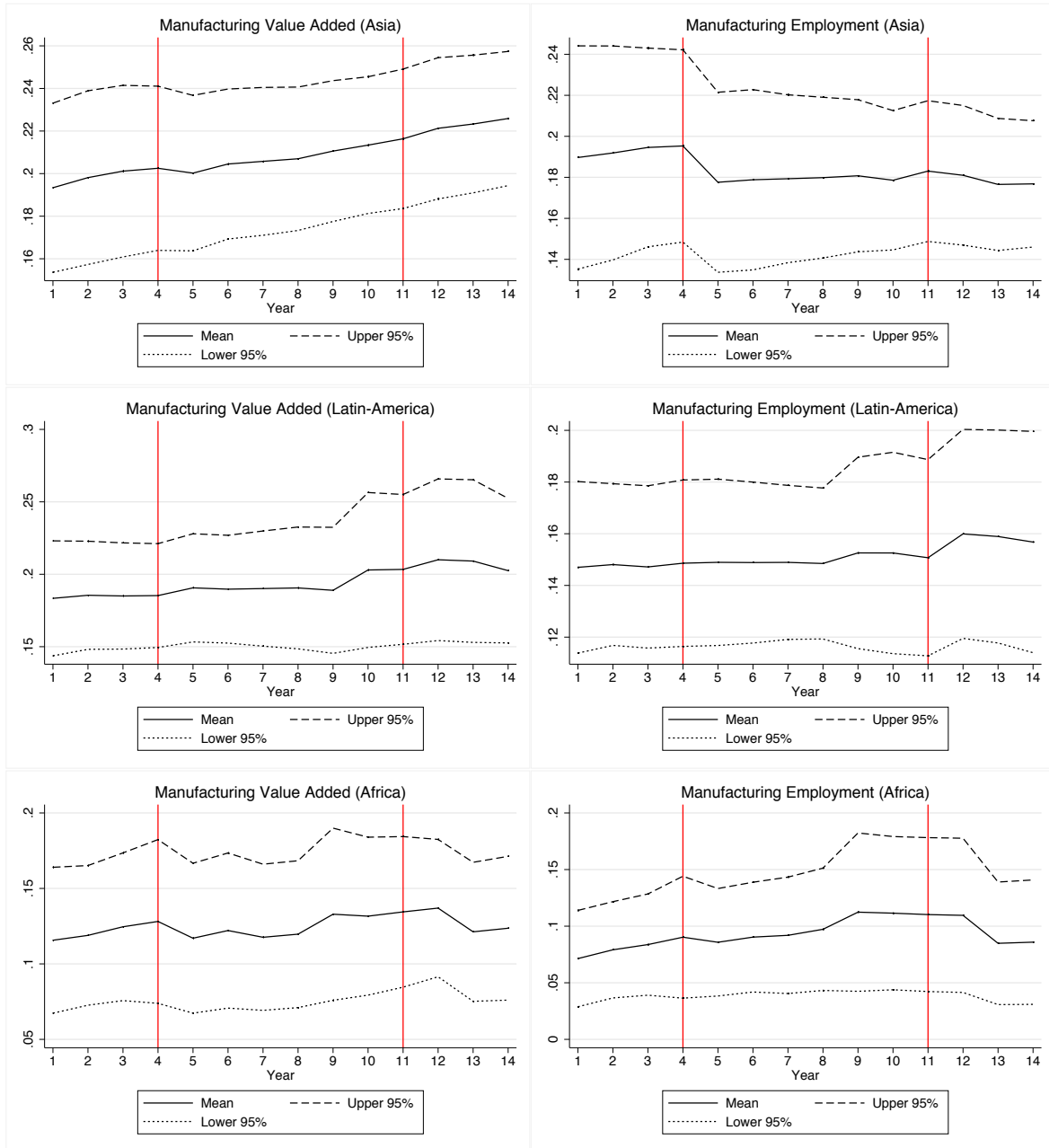


Figure 5: Trade Balance, Exports and Imports, as Shares of GDP During Episodes

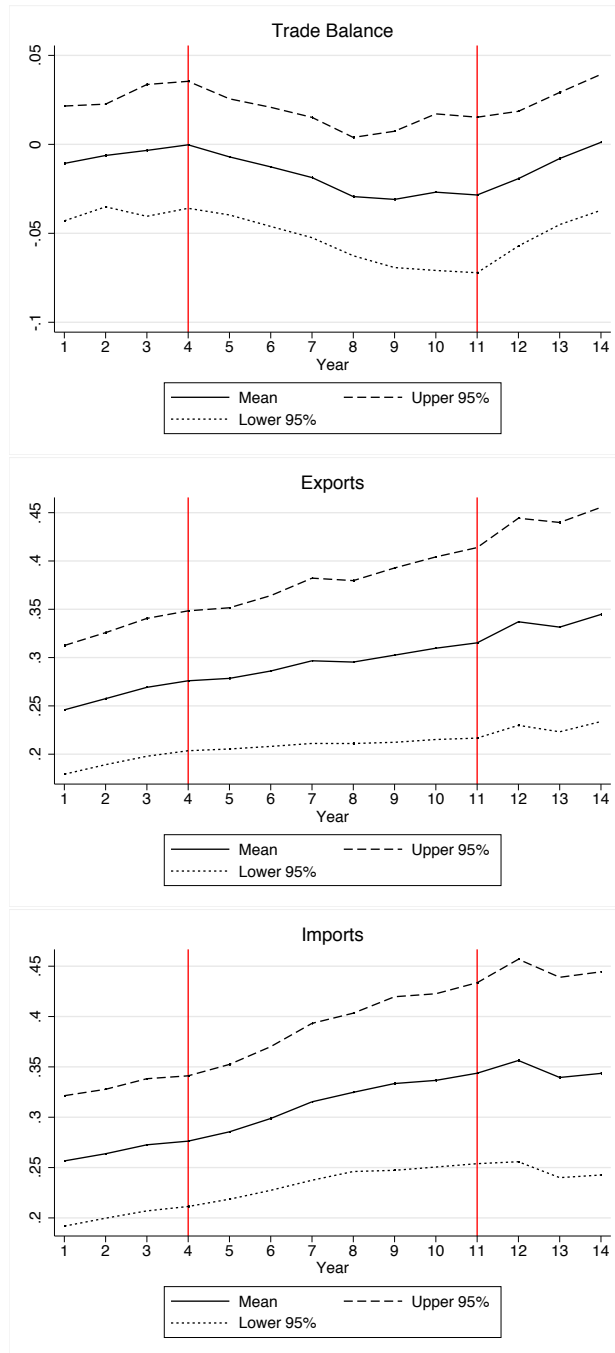
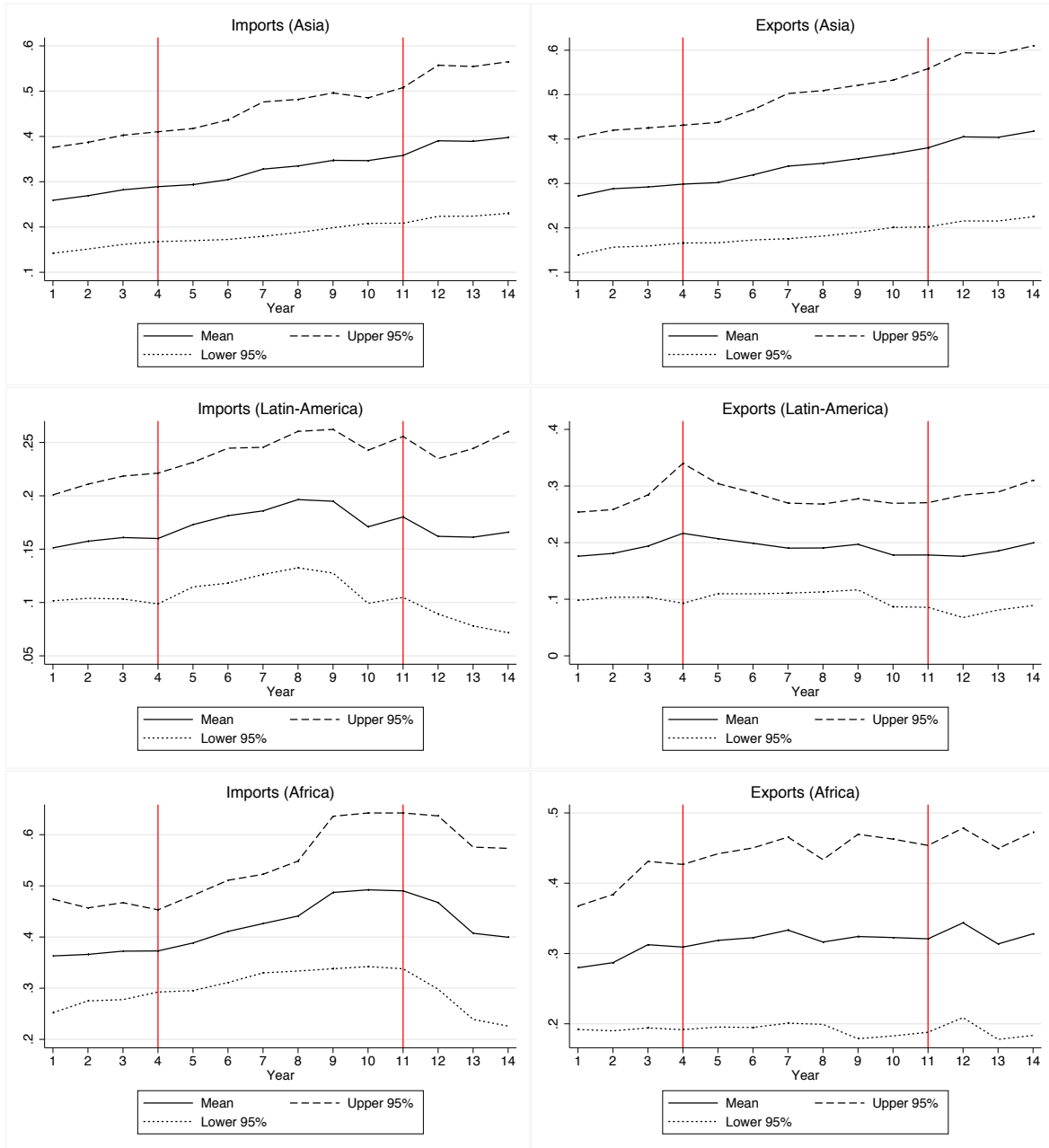


Figure 6: Exports and Imports as Shares of GDP During Episodes by Region



8 Appendix. Additional Robustness Checks

This appendix presents additional estimates of the determinants of sustained investment surges using different models from the limited dependent variable family. Table 16 replicates the results displayed in Table 7 using logit instead of probit. Broadly the main results continue to hold, except that *Underval* is not significant in the first and the last two columns.

An important source of concern is the sensitivity to sample changes. As we include additional covariates, some of the previous results may fail to hold. A way to mitigate this problem is to employ the smallest sample possible. Thus, we eliminate all the observations that do not have the entire set of covariates. Table 17 presents these results. Reassuringly, the main results continue to hold.

Table 18 presents additional alternative models. The first column shows the standard results from a logit model. We report the log of the odds ratios.²⁵ The odds ratios represent the ratio of the likelihood of the “positive” outcome over the “negative” outcome; in our case, the likelihood that episode dummy is equal to one, over the likelihood that the episode dummy is equal to zero. For example a coefficient of 1.2 means that the positive outcome is 20 per cent more likely than the negative outcome (when the independent variable is increased by one unit), while a coefficient of 0.8 means that the negative outcome is 20 per cent less likely. Table 18 present the log of the odds ratio, so the negative coefficients indicate an odd ratio lower than 1, and thus an increase in the independent variable lowers the likelihood of an episode, while ratios larger than 1 are associated with positive coefficients, increase it.²⁶

The second and third column implements the Conditional Logit model. Conditional Logit models are useful to analyze how the characteristics of the different choices affect the likelihood of the individuals to pick among them. We group countries according to some common characteristic: countries that experienced an episode in the past (column 2) and anywhere in the sample (column 3). This accounts for the fact that countries that experience episodes may have some features that make them more likely to experience another episode in the future.

The fourth and fifth columns introduce the Re-logit and the Firth logit models. These two models account for the presence of rare events by penalizing the standard estimations. In our sample the number of observations associated with an episode taking place is relatively small compared to the number of observations where no episode takes place, and the ratio gets lower as we include additional covariates with limited coverage. We present results for a first specification that includes the covariates with a broad coverage, and the last specification, which cuts the number of observations to about one sixth of the original sample of around 6,200.

The purpose of Table 18 is to search for unexpected changes in the coefficient. It is reassuring

²⁵Unfortunately, there is no easy way to estimate the average marginal effect for all the set of models that we will present in Table 18 (in particular the Firth-logit and the Re-logit). We choose to stick with the “raw” estimations” (without estimating the average marginal effects) in order to compare the different models.

²⁶In other words, the coefficients from a logit model are defined as the (natural) logs of the odds ratios.

to see that the results do not depend on the type of model adopted. Notice that the signs, the statistical significance, and the size of the effects are more or less similar in different models. We can verify that most of the variables that were consistently important in our baseline specification remain important using alternative models, except perhaps for inflation (but it was close to being not significant in the last specification of the baseline results).

Table 16: Robustness Logits - Average Marginal Effects

Dependent Variable: Episode Dummy					
Model	(1) Logit	(2) Logit	(3) Logit	(4) Logit	(5) Logit
Underval	0.009 (0.007)	0.037*** (0.014)	0.070*** (0.027)	0.034 (0.029)	0.049 (0.031)
Capital_Output	-0.058*** (0.006)	-0.078*** (0.010)	-0.150*** (0.026)	-0.106*** (0.027)	-0.097*** (0.027)
Fiscal		0.014 (0.010)	0.013 (0.018)	0.008 (0.019)	0.003 (0.019)
Inflation		-0.061** (0.027)	-0.055 (0.050)	-0.069 (0.047)	-0.075 (0.048)
XR_Stability		0.016 (0.015)	-0.018 (0.030)	-0.042 (0.031)	-0.050 (0.031)
Crisis_5y			-0.032* (0.019)	-0.029* (0.017)	-0.024 (0.018)
Rents			-0.000 (0.001)	-0.002** (0.001)	-0.002** (0.001)
Trade			0.010 (0.022)	-0.010 (0.025)	-0.029 (0.028)
KA_Open			0.002 (0.006)	0.006 (0.007)	0.007 (0.007)
NET_Inflows			-0.308* (0.167)	-0.799*** (0.192)	
FDI_Inflows					-0.002 (0.004)
Port_Inflows					-0.009*** (0.002)
Reserves					0.010** (0.004)
TOT			-0.053 (0.043)	0.011 (0.048)	0.012 (0.048)
FF_Rate			-0.002 (0.003)	0.000 (0.003)	0.002 (0.003)
Global_Uncertainty			-0.002 (0.002)	-0.003 (0.002)	-0.003 (0.002)
Human_Capital				0.142*** (0.053)	0.135** (0.053)
Capita_GDP				-0.073*** (0.020)	-0.069*** (0.020)
Durable				-0.001*** (0.000)	-0.001*** (0.001)
R-squared	0.033	0.064	0.126	0.166	0.183
Observations	6,791	3,117	999	967	951

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 17: Probits with the Smallest Sample - Average Marginal Effects

Dependent Variable: Episode Dummy					
Model	(1) Probit	(2) Probit	(3) Probit	(4) Probit	(5) Probit
Underval	0.063** (0.026)	0.060** (0.025)	0.079*** (0.026)	0.043 (0.028)	0.052* (0.028)
Capital_Output	-0.104*** (0.025)	-0.110*** (0.024)	-0.110*** (0.025)	-0.102*** (0.026)	-0.092*** (0.026)
Fiscal		0.008 (0.017)	0.027 (0.018)	0.006 (0.019)	-0.000 (0.018)
Inflation		-0.080* (0.048)	-0.068 (0.049)	-0.072 (0.046)	-0.079* (0.047)
XR_Stability		-0.024 (0.029)	-0.030 (0.030)	-0.043 (0.031)	-0.050* (0.030)
Crisis_5y			-0.020 (0.018)	-0.024 (0.018)	-0.019 (0.018)
Rents			-0.001* (0.001)	-0.002** (0.001)	-0.002** (0.001)
Trade			0.004 (0.024)	-0.010 (0.025)	-0.037 (0.028)
KA_Open			0.006 (0.006)	0.006 (0.007)	0.007 (0.007)
NET_Inflows			-0.653*** (0.200)	-0.808*** (0.200)	
FDI_Inflows					-0.002 (0.004)
Port_Inflows					-0.009*** (0.002)
Reserves					0.011** (0.004)
TOT			0.004 (0.046)	0.005 (0.048)	0.006 (0.048)
FF_Rate			0.001 (0.003)	0.000 (0.003)	0.001 (0.003)
Global_Uncertainty			-0.002 (0.002)	-0.003 (0.002)	-0.003 (0.002)
Human_Capital				0.137** (0.054)	0.132** (0.054)
Capita_GDP				-0.071*** (0.020)	-0.068*** (0.020)
Durable				-0.001*** (0.001)	-0.002*** (0.000)
Pseudo R-squared	0.055	0.065	0.096	0.148	0.167
Observations	951	951	951	951	951

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 18: Robustness Logits - Logs of the Odds Ratios

Dependent Variable: Episode Dummy					
Model	(1) Logit	(2) Conditional Logit	(3) Conditional Logit	(4) Relogit	(5) Firth Logit
Underval	0.855 (0.534)	0.930* (0.540)	1.627*** (0.592)	0.762 (0.714)	0.848* (0.505)
Capital_Output	-1.687*** (0.470)	-1.857*** (0.464)	-1.865*** (0.461)	-1.624*** (0.574)	-1.591*** (0.456)
Fiscal	0.052 (0.329)	0.056 (0.348)	0.106 (0.344)	0.049 (0.329)	0.017 (0.317)
Inflation	-1.304 (0.836)	-1.158 (0.944)	-1.994** (0.982)	-0.963 (0.614)	-0.009 (0.018)
XR_Stability	-0.864 (0.529)	-0.933* (0.542)	-0.920* (0.553)	-0.803 (0.525)	-0.509 (0.490)
Crisis_5y	-0.422 (0.307)	-0.472 (0.314)	-0.610* (0.321)	-0.401 (0.301)	-0.518* (0.298)
Rents	-0.035** (0.015)	-0.036** (0.016)	-0.040** (0.016)	-0.031* (0.017)	-0.031** (0.015)
Trade	-0.501 (0.483)	-1.002* (0.520)	-0.672 (0.513)	-0.439 (0.468)	-0.304 (0.454)
KA_Open	0.115 (0.122)	0.128 (0.126)	0.021 (0.127)	0.112 (0.145)	0.127 (0.120)
FDI_Inflows	-0.030 (0.074)	0.015 (0.087)	-0.031 (0.077)	-0.026 (0.063)	-0.021 (0.072)
Port_Inflows	-0.154*** (0.030)	-0.140*** (0.031)	-0.143*** (0.031)	-0.146*** (0.025)	-0.138*** (0.029)
Reserves	0.182** (0.072)	0.156** (0.073)	0.158** (0.072)	0.175*** (0.061)	0.171** (0.070)
TOT	0.206 (0.832)	0.454 (0.818)	0.381 (0.828)	0.167 (0.759)	-0.083 (0.767)
FF_Rate	0.028 (0.052)	-0.027 (0.056)	-0.055 (0.057)	0.030 (0.047)	0.012 (0.049)
Global_Uncertainty	-0.058 (0.036)	-0.052 (0.036)	-0.048 (0.037)	-0.056 (0.036)	-0.052 (0.035)
Human_Capital	2.350** (0.917)	1.884* (1.019)	0.720 (1.116)	2.244*** (0.817)	2.081** (0.895)
Capita_GDP	-1.200*** (0.345)	-1.710*** (0.440)	-0.999*** (0.387)	-1.150*** (0.331)	-1.150*** (0.327)
Durable	-0.026*** (0.009)	-0.038*** (0.010)	-0.048*** (0.011)	-0.024*** (0.007)	-0.022*** (0.008)
Constant	9.649** (4.578)			9.304** (3.718)	10.156** (4.413)
Observations	951	951	708	951	951

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

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