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Drivers of Investment Accelerations

Abstract

Following earlier studies on accelerations of output and the capital stock, we propose an adjusted method to identify accelerations in investment that ensures that the identified episodes are characterized by sustained increases in per capita investment growth to a relatively high rate. We identify 192 investment accelerations in 93 economies (34 advanced economies and 59 emerging and developing economies) over 1950-2022. Our evidence suggests that economic policy reform and institutional quality are important drivers of the likelihood that such an acceleration occurs. Furthermore, we find that the impact of reform on this likelihood is conditioned by institutional quality.

JEL-Codes: E220, O110, O430.

Keywords: investment accelerations, institutional quality, policy reform governance.

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1. Introduction

Despite the extensive discussion about the urgent need to raise investment growth in the developing world, there is limited research on investment accelerations—defined as periods in which there is a sustained increase in investment growth to a relatively high rate. A fuller understanding of these accelerations and their drivers could provide useful lessons for achieving long-term growth and development.

This paper is the first to identify country-level investment accelerations and to analyze the drivers of such episodes. The study most closely related to our work is by Libman et al. (2019), who identify 175 episodes of accelerated capital stock growth that last eight years or longer and find that such episodes are more likely in countries with competitive real exchange rates, macroeconomic stability (low inflation), and an accumulation of net foreign assets. We focus on investment growth accelerations for three reasons. First, it is interesting to examine how surges in one of the components of GDP growth are related to GDP growth accelerations. While higher investment growth obviously contributes to higher output growth, output may also grow due to other reasons. It is thus very well possible that both types of accelerations may not be (strongly) related.[1] Second, calculating the capital stock requires several assumptions which implies that capital stock growth data are probably much noisier than investment growth data. Finally, it is easier to target investment accelerations than capital stock accelerations with economic policies.

We build upon studies identifying accelerations in economic growth (Hausmann et al., 2005; Jong-A-Pin and de Haan, 2011). The underlying idea of the growth accelerations approach is to identify episodes during which real output (or, in our case: investment per capita) grows much faster than before and to link such episodes of sustained growth to a range of institutional and policy characteristics of the countries considered (see section 2 for more details).

The paper addresses two research questions. First, what are the key characteristics of investment accelerations? Second, what drives investment accelerations? In particular, we analyze whether investment accelerations are related to institutional quality and policy reforms. Based on an analysis of European Union countries, Thum-Thysen et al. (2019) argue that ensuring competitive markets and business-friendly regulations play a crucial role in unlocking

[1] Koopman and Wacker (2023) find on the basis of a growth accounting exercise that GDP growth accelerations are mainly driven by improvements in total factor productivity.

investment. Our analysis covers 93 economies (34 advanced economies and 59 emerging and developing economies) over 1950-2022.

We identify 192 investment accelerations in our sample. Our main results suggest that our proxies for economic policy reform and the quality of economic institutions are important drivers of the likelihood that an investment acceleration occurs. Furthermore, we find that the impact of economic policy reform on the likelihood of the occurrence of an investment growth acceleration is conditioned by institutional quality. This suggests that investment-friendly policy reforms may have less impact on investment growth accelerations in the absence of secure property rights and contract enforcement.

The remainder of the paper is organized as follows. Section 2 discusses related research. Section 3 outlines how we identify investment growth accelerations. Section 4 offers our analysis of the drivers of investment accelerations and section 5 presents a series of robustness analyses. Section 6 concludes.

2. Overview of related literature

2.1 (Output) growth accelerations

Probably the best-known study of (output) growth accelerations is by Hausmann et al. (2005). These authors identify instances of rapid acceleration in economic growth that are sustained for at least eight years. They find more than 80 such episodes since the 1950s that tend to be correlated with economic reforms and political regime changes.[2] Following up on the research by Hausmann et al. (2005), Jong-A-Pin and de Haan (2011) propose an adjusted way to identify growth accelerations, arguing that their methodology yields more plausible starting dates of growth acceleration episodes. Using data for 106 countries over the period 1957–1993, these authors identify 89 growth accelerations. Their results suggest that economic growth accelerations are preceded by economic liberalization but not by political regime changes.

Avom et al. (2021) use a very similar methodology as Hausmann et al. (2005) to identify growth accelerations in 33 sub-Saharan African countries. They find, amongst others, that institutional quality, and world demand increase the probability of an acceleration. Moreover, their results suggest that economic and political reforms precede growth accelerations. Growth

[2] However, as shown by Jong-A-Pin and de Haan (2008), the latter result was due to a coding mistake.

reversals (defined symmetrically to growth accelerations)[3] are associated, amongst others, with low global demand, higher inflation, and less liberalization. In a study for a group of 22 Western African economies for the period 1960–2006, Iman and Salinas (2008) report similar results. Likewise, Gruss et al. (2020) find that strong external demand and financial conditions significantly increase the probability of growth accelerations, while a strengthening of these conditions significantly decreases the probability of reversals. Certain domestic policies and structural attributes, including exchange rate flexibility, trade integration, and strong institutional frameworks, can significantly amplify or mitigate the effect that shifts in external conditions have on growth patterns in emerging market and developing economies.

Peruzzi and Terzi (2021) employ the growth accelerations identified by Karr et al. (2013). The authors identify large positive changes in potential drivers of these accelerations and pair this information with growth accelerations. They conclude that large orthodox economic policy shifts precede almost 60 percent of growth acceleration episodes.

Instead of using a filter to identify (output) growth accelerations, some papers use a statistical approach to identify breaks in output growth. For instance, Jones and Olken (2008) identify structural breaks in output growth using the methodology of Bai and Perron (1998, 2003). They identify 73 breaks in 48 countries of which 43 are down-breaks and 30 up-breaks.[4] Importantly, their results suggest that growth accelerations and collapses are asymmetric phenomena, which suggests that the problem of sustaining growth—i.e., preventing a growth deceleration—is a different problem than the problem of engineering a growth takeoff. Although studies focusing on breaks in output growth are clearly related to the literature on growth accelerations, there is one important difference, namely that studies on output growth

[3] Several other papers, including Hausmann et al. (2008), Joyce and Nabar (2009), Eichengreen et al. (2012; 2014), and Ayar et al. (2018), have also examined output growth decelerations, using different methodologies to identify such episodes.

[4] Berg et al. (2012) study the duration of growth spells identified using the Bai-Perron approach to identify breaks and growth spells. Arizala et al. (2017) report that growth spells in Sub-Saharan Africa are sustained by the fiscal policy that prevents excessive public debt accumulation, monetary policy geared toward low inflation, outward-oriented trade policies, and structural policies that reduce market distortions, as well as supportive external environment and improvements in democratic institutions. Kar et al. (2013) propose an approach that combines the filter and the Bai-Perron approaches. Using GDP per capita data for 125 countries for the period 1950–2010, the authors identify a much larger number of breaks in GDP per capita than a purely statistical approach.

accelerations are interested in episodes of sustained growth, whereas a break in output growth may also reflect a cyclical recovery.[5]

2.2 Capital stock accelerations

Libman et al. (2019) identify 175 episodes of accelerated capital stock growth that last eight years or longer. Their main results suggest that surges in capital stock growth are more likely in countries with competitive real exchange rates, macroeconomic stability (low inflation), and an accumulation of net foreign assets. Moreover, such episodes are more likely to prove sustainable in the long run if they are not preceded by financial crises. Furthermore, episodes of accelerated capital stock growth are positively correlated with higher levels of human capital.[6] In a recent analysis, Manzano and Saboin (2022) examine the factors initiating capital growth surges (identified as in Libman et al., 2019) in an unbalanced panel of 178 countries for the period 1950–2019. They find that improvements in law and order have a positive effect on the probability of initiating a capital stock surge.

3. Identifying investment accelerations

3.1 Method

The proposed methodology imposes the following rules to identify investment accelerations, that is, periods with sustained, rapid, and high investment per capita[7] growth rates:

(1) Each episode must be sustained for at least six years.[8] The duration of episodes is selected to exclude purely cyclical rebounds in investment growth.

(2) The average annual growth rate of investment per capita in the acceleration episode must be at least 4 percent. This growth rate corresponds to the long-run median growth rate

[5] A related line of literature zooms in on such recoveries (see, for instance, Aizenman and Spiegel, 2010 and Menes and Saboin, 2021).

[6] Hoyos et al. (2021) used those identified capital stock growth acceleration episodes to explore the impact of sustained investment surges on structural changes. They found that periods of atypically high investment do not necessarily result in increased economic complexity and diversification of export structure.

[7] Using per capita growth in investment takes into account the significance of population growth, which has averaged more than 2 percent in the typical EMDE between 1950 and 2022.

[8] According to Barro and Sala-i-Martin (1992) and Christiano and Fitzgerald (2003), economic indicators that are more than five calendar years apart are less influenced by business cycle fluctuations. Whereas Hausmann et al. (2005) require output growth accelerations to have heightened output growth for at least eight years, in view of the volatile nature of investment growth, we use a minimum of six years.

of investment for the top one-third of countries between 1950 and 2022. Because of the volatile nature of investment growth, a 4 percent threshold was selected because it is sufficiently high, and surpassing an average growth rate of 4 percent is unlikely to be driven by one year of very high growth.

(3) To ensure that the episode is an acceleration, the average per capita growth rate of investment must be at least 2 percentage points higher than the average of the previous six years. This minimum required increase is the median difference in investment growth between two neighboring six-year periods for the top one-third of countries in the sample.

(4) In addition, to ensure that the episode is not merely a cyclical recovery, the level of per capita capital stock at the end of the period must exceed its pre-episode peak.

Apart from these major requirements, a few additional requirements are added to avoid overidentifying investment accelerations and to identify more reasonable episodes and starting years. These requirements are specifically added to tailor the filtering approach to the volatile nature of investment growth. First, to exclude episodes driven by short-term surges in investment, the approach mandates that investment growth must be positive in at least five out of the six years of an acceleration period. Second, the investment per capita growth rate at the beginning of the six-year period should not be negative. Third, per capita investment has to accelerate and be higher in the second year of an episode than in the first year. Finally, if more than one year qualifies as the start of the investment acceleration episode, the first year that meets the criteria is identified as the start (cf. Jong-A-Pin and de Haan, 2011).

In addition to defining the start of an acceleration, accelerations can have varying duration. An acceleration is considered to end when per capita investment growth turns negative, or when the inclusion of the current year reduces the average annual per capita investment growth rate since the start of the acceleration to below 4 percent.

Our identification approach aligns with studies on (output) growth and capital stock accelerations as discussed in section 2 but differs in two key dimensions: the duration of heightened growth required and the main criteria for identifying accelerations. First, previous studies on accelerations typically adopt an eight-year framework without adapting to the volatile nature of investment growth. Second, the values for various criteria detailed above are taken from sample statistics, while other studies used ad-hoc values (for instance, Hausmann et al. 2005; Jong-A-Pin and de Haan, 2011).

We employ data from the Penn World Table (PWT) 10.01 as this database covers many more countries than alternative databases and a sufficiently long period of time over 1950-2019.

To update the investment and capital stock data provided by PWT to 2022, we use investment growth data from Haver Analytics and databases from the World Bank using the Perpetual Investment Methodology as applied in PWT. Investment and output data are converted into per capita terms using population data from PWT and the United Nations World Population Prospects database. The dataset covers up to 104 countries, including 35 advanced economies (AEs) and 69 emerging and developing economies (EMDEs), for the 1950-2022 period. Based on the length of six years and the sample's end year of 2022, the latest year an acceleration can start is in 2017.

3.2 Results

Table A.1 in the Appendix shows the investment acceleration periods as identified under the approach outlined above. We identify 192 investment accelerations in 93 economies (34 AEs and 59 EMDEs) over the period 1950-2022. Eleven of the 104 countries in the sample experienced no acceleration. In some countries, investment was so volatile that no significant increase in investment growth lasted as long as six years, while in others, periods of rapid investment growth were relatively short-lived and were insufficient to raise the capital stock to its pre-acceleration peaks. Among the countries that experienced at least one investment acceleration, fewer than one-third of them had three or more investment accelerations. In countries with multiple accelerations, on average, about 10 years passed between two episodes, with a few exceptions.

On average, an EMDE experienced about 1.7 investment accelerations between 1950 and 2022, compared to about 2.2 such episodes in an advanced economy. Table 1 shows the distribution of accelerations over time and across AEs and EMDEs.[9] The first column shows the number of countries in each country group during every decade, which increases over time as more data becomes available for EMDEs, while some countries graduate into the AE group.

[9] In Table 1, we use the classification of the World Bank's Prospects Group for the fiscal year 2024.

Table 1. Investment growth accelerations: distribution over decades

Decade:	(1) Number of countries (with available data)		(2) Number of investment accelerations	
	AEs	EMDEs	AEs	EMDEs
1950s	25	30	4	1
1960s	28	49	13	14
1970s	28	64	3	17
1980s	28	64	17	11
1990s	35	69	18	23
2000s	35	69	11	33
2010s	35	69	11	16

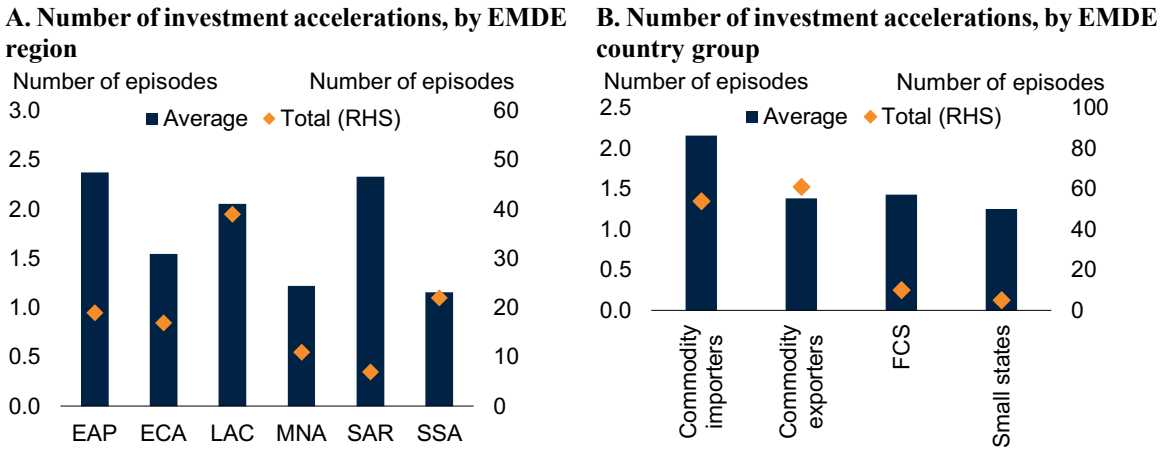
Notes: the classification of advanced economies (AEs) and emerging market and developing economies (EMDEs) follows World Bank (2024).

We find two waves of investment accelerations, one in the 1960s and one in the 2000s. During the latter period, 42 percent of all countries had an investment acceleration. In the following decade only about a quarter of the world's economies had one. This decline was fully accounted for by EMDEs, as the share of advanced economies with accelerations was virtually unchanged.

Figure 1 shows the average number of investment accelerations per country for several country groups.[10] As the left-hand side graph of Figure 1 shows, across EMDE regions as identified by the World Bank, the highest number of investment accelerations per country (nearly 2.4) occurred in East Asia and Pacific (EAP), which registered higher investment growth than most other regions over the past seven decades, closely followed by South Asia (SAR). Latin America and Caribbean (LAC) had the highest number of total investment accelerations. The right-hand side graph of Figure 1 shows that across EMDE country groups, commodity exporters, economies facing fragile and conflict-affected situations (FCS), and small states experienced fewer investment accelerations than other country groups. This probably reflects the high volatility of their investment.

[10] See World Bank (2024) for detailed group classifications.

Figure 1. Distribution of investment accelerations across EMDE regions and country groups



Source: Own calculations using Penn World Table 10.01 (updated to 2022).
Notes: Here advanced economies are excluded. Graph A shows the average number investment accelerations by EMDE regions (EAP = East Asia and Pacific; ECA = Europe and Central Asia; LAC = Latin America and Caribbean; MNA = Middle East and North Africa; SAR = South Asia; SSA = Sub-Saharan Africa). Graph B shows the same information for EMDE country groups (FCS= Fragile and conflict-affected situations). Bars show the average number of investment accelerations per country over the period 1950-2022, while diamonds show the total number of episodes between 1950 and 2022.

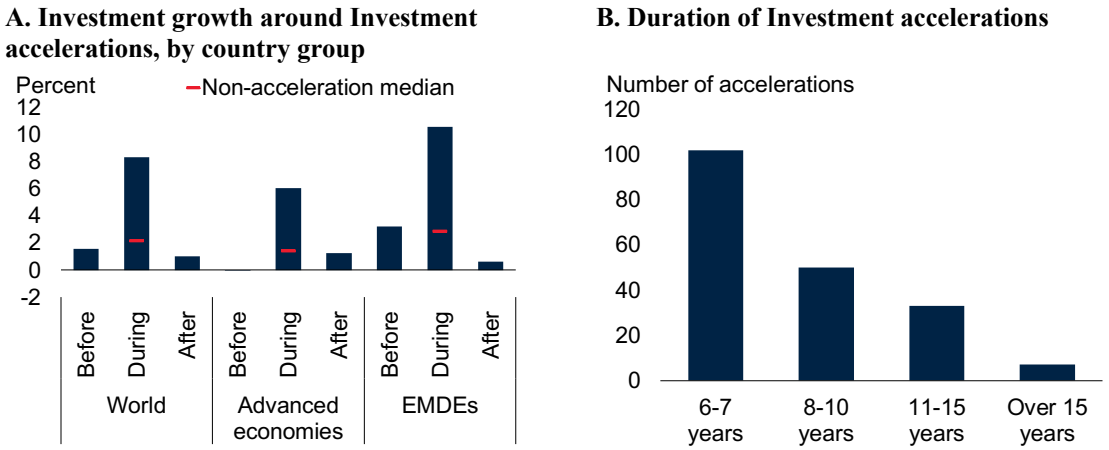
The left-hand side graph in Figure 2 shows investment growth before, during, and after the acceleration episodes. EMDEs typically experienced a greater increase in investment growth than AEs. Reflecting the higher volatility of investment, EMDEs also typically experienced a larger decline in investment growth in the six years following the end of an acceleration compared to AEs. The basic pattern of investment growth over the three stages of acceleration episodes shows only minor differences across EMDEs in different regions and country groups.[11]

The right-hand side of Figure 2 shows the duration of investment growth acceleration episodes. Most accelerations lasted six to seven years, with a median duration of seven years. One-fifth of accelerations lasted longer than 10 years.[12]

[11] The results are not shown here but will be made available upon request.

[12] The latter finding illustrates that using a fixed period of 8 years to identify acceleration episodes, as commonly used in previous studies on output growth accelerations, is problematic. Precisely identifying the start and end points of accelerations is important for analyzing the drivers of investment growth accelerations as well as the factors determining their duration.

Figure 2. Characteristics of investment growth accelerations



Sources: Own calculations using data from Feenstra et al. (2015); Haver Analytics; and World Development Indicators (the WDI database).
Notes: EMDEs = emerging market and developing economies. In panel A, bars show median annual investment growth during the six years before, the entire duration of, and the six years after an investment acceleration. At the 10 percent level, differences between before, during, and after periods are statistically significant unless otherwise specified. Red tick mark indicates the median investment growth rate during non-acceleration years in the sample. In panel B, bars show the number of investment accelerations that fall into each duration category.

4. Drivers of investment accelerations

4.1 Data

We examine how the quality of economic institutions (IQ) and economic policy reform (EPR) are associated with the probability of starting an investment acceleration. To measure institutional quality and economic policy reform, we use the Fraser Institute Index, which has been shown to be closely related to the Washington Consensus (de Haan et al., 2006; Grier and Grier, 2021). The index contains components referring to institutions and components referring to policies (de Haan et al., 2006). The index thus suffers from the critique of Glaeser et al. (2004) on many proxies for institutional quality, namely that they do not capture institutions (i.e., enduring constraints that determine the rules of the game), but policies (i.e., the outcomes of the game). Nevertheless, it is straightforward to decompose the index into a component capturing policies and a component capturing institutions. This allows us to analyze the impact of institutional quality and economic policy reforms on economic growth.

The Fraser Institute's index comprises five sub-categories: (1) the size of government, (2) legal structure and security of property rights, (3) access to sound money, (4) freedom to trade internationally, and (5) regulation of credit, labor, and business (Gwartney et al., 2019). The second subcategory refers to institutional quality, while the other subcategories refer to policies. We, therefore, have constructed an institutional quality measure based on the level of

the second subcategory and a policy reform variable based on the percentage change in the average of the other four subcategories of the index.[13]

One of the drawbacks of the Fraser Institute index is that it is a composite index capturing many different dimensions of institutional quality and economic policy. In order to check the robustness of our findings, we employ different indicators of IQ and EPR in the sensitivity analysis. More specifically, institutional quality is proxied by the "law and order" subcomponent of the PRS Group's *International Country Risk Guide* (ICRG). EPR is proxied by trade and capital account restrictions. The trade restrictions index is taken from the IMF structural reform database (Alesina et al., 2020) and the IMF AREAER database. The capital account restrictions index is taken from Chinn and Ito (2008). Here we also consider the level of government debt as a proxy for the sustainability of fiscal policy.

4.2 Preliminary analysis

Before turning to more formal econometric estimates, we first examine (a) what proportion of investment growth acceleration episodes is preceded or accompanied by changes in institutional quality and economic policy reform, and (b) what proportion of changes in institutional quality or economic policy reform is accompanied or followed by investment accelerations. The timing of the investment accelerations is taken to be the 3-year period centered on the dates listed in Table A1 in Appendix 1. A 3-year window reduces the probability that we will narrowly miss the timing of an acceleration through quirks in the data or in our method.

To enable a comparison with investment acceleration episodes, we construct dummies that are 1 for episodes during which improvements in the two measures based on the Fraser Institute index (institutional quality and economic policy reform) are at least 2 percent higher over the previous five years and zero otherwise. Whenever the 3-year window of an investment acceleration overlaps with the 5-year window for improvements in institutional quality or economic policy reform, we count it as a case where the investment acceleration coincides with institutional quality improvement or policy reform.

[13] We use percentage changes instead of absolute increases, as used by Grier and Grier (2021), because an absolute increase in the index is easier to accomplish if the level of the index is low than when it is high. The Fraser Institute index is available on an annual basis from 2000; before that year it is only available at 5-year frequency. See Appendix 2 for an explanation how we calculate our measures before 2000.

Table 2. Investment surges and improvements in institutional quality and economic policy reform

Proportion of investment growth accelerations that are preceded or accompanied by:	
Institutional reforms	36.9
Policy reforms	50.9
Proportion of reforms that are accompanied or followed by investment growth acceleration:	
Institutional reforms	9.75
Policy reforms	10.2

Notes: The cells compute the overlaps between the 3-year window of accelerations and the preceding 5-year window of improvements in institutional quality and economic policy reform, using a threshold of 2 percent for the Fraser Institute variables.

The first panel in Table 2 shows the extent to which investment accelerations are preceded or accompanied by improvements in institutional quality or economic policy reform. The results suggest that investment surges are often preceded by institutional and policy reforms. For example, almost 40 percent of investment growth accelerations are preceded or accompanied by institutional reforms, and even more (over 50 percent) by policy reforms.

The second panel in Table 2 shows the extent to which improvements in institutional quality or economic policy reform are accompanied or followed by an investment growth acceleration. Most of these episodes with improvements are not followed by investment growth. Around 10 percent of reforms are followed by investment accelerations. This suggests that introducing reforms is no guarantee for investment accelerations.

4.3 Econometric analysis: model specification

To identify the drivers of surges in investment, we use logit regressions.[14] More formally, we estimate the following model:

$$Pr\left(Y_{i,t} = 1 \middle| X_{i,t}\right) = \phi(\beta X_{i,t})$$

where *Pr* denotes the probability that a sustained investment growth acceleration ($Y_{i,t}$) takes place, conditioned on a set of variables ($X_{i,t}$), and ϕ denotes the cumulative distribution function. The unconditional probability of experiencing an investment acceleration in a decade is calculated by dividing the number of identified investment accelerations by the total number of country-years in the sample during which an acceleration could occur. As there is some uncertainty around the precise starting date of an investment growth acceleration episode, we follow Hausmann et al. (2005) and expand our dependent variable to also take the value 1 the

[14] Our main results do not change when using probit regressions, which will be provided upon request.

immediate year before and the year after the beginning of the episode, and 0 otherwise. We do not use fixed effects (FE) as that would imply dropping all countries that had no investment acceleration during our sample period (cf., Hausman et al., 2005; Libman et al., 2019).

We focus on the effect of (lagged) institutional quality (*IQ*) and economic policy reform (*EPR*) on the likelihood that an investment acceleration occurs. Data for these variables are available for a large set of countries over a long time period and these variables are highly relevant from a policy perspective (Thum-Thysen et al., 2019). In our base model, we include the level of institutional quality, the economic policy reform indicator, and their interaction. We hypothesize that the impact of economic policy reform on the likelihood of an investment acceleration is conditioned by institutional quality. To exemplify: investment-friendly policy reforms may not have any impact on investment accelerations in the absence of secure property rights and contract enforcement.

So, our model is:

$$Pr\left(Y_{i,t} = 1 \middle| X_{i,t}\right) = \phi(\beta_1 IQ_{i,t-1} + \beta_2 EPR_{i,t-1} + \beta_3 (IQ_{i,t-1} * EPR_{i,t-1}) + \beta_4 CV_{i,t-1} + \mu_{i,t})$$

where *CV* are the control variables. We started with a large set of control variables that have been considered in previous studies on capital stock and output accelerations. It turned out that many of these controls were not significant and did not affect our main findings (detailed results are available on request). Furthermore, the availability of some of the control variables limits the number of observations (sometimes considerably). We, therefore, decided to keep our base model small and only take up (lags of) controls for country-specific conditions that capture the level of capital (capital-to-output ratio), capital inflows to GDP, and the undervaluation index following Rodrik (2008).[15] In addition, we include global GDP growth to control for global economic conditions.

4.4 Econometric analysis: baseline results

Table 3 shows the baseline results for the impact of institutional quality and economic policy reform on the probability that an investment surge episode starts. In column (1) we only

[15] A competitive exchange rate can facilitate investment either by boosting higher-income households' propensity to save and invest or by supporting the tradables sector (Gluzmann et al., 2013; Guzman et al., 2018). In both cases, maintaining a competitive currency may help initiate and sustain investment accelerations.

consider our proxy for institutional quality and the controls (the lags of: undervaluation of the exchange rate, the capital-to-output ratio, capital inflows to GDP, and global GDP growth). In column (2) we add our proxy for economic policy reform. Finally, in column (3) we add the interaction between IQ and EPR. The variables based on the Fraser Institute index have been demeaned.

The results suggest that the impact of policy reform on the probability of an investment acceleration is conditional on the level of institutional quality. At low levels of institutional quality, policy reforms have a negative effect, while at high levels of institutional quality economic policy reforms have a positive impact. This is shown in the left-hand side panel of Figure 3, which plots the marginal effect of economic policy reform on the likelihood of an investment growth acceleration for different levels of institutional quality based on the model presented in column (3) of Table 3. The figure shows that at low levels of institutional quality, economic policy reforms have no effect on the probability of an investment surge, but at higher levels of institutional quality, these reforms increase the probability of an investment surge.

The right-hand side panel of Figure 3 exemplifies this role of institutional quality. The predicted probability of experiencing an investment acceleration for a country with an institutional quality value at the bottom 5th percentile is around 10.1 percent, or in other words once every 10 years. Improving institutional quality from the bottom 5th percentile to the median while holding all other covariates constant increases the probability of starting an investment acceleration to 14.3 percent or every 7 years. Increasing institutional quality to the top 95th percentile (i.e., the level prevalent in countries like Iceland, the Netherlands, and Sweden), would increase the probability to every 4.2 years.

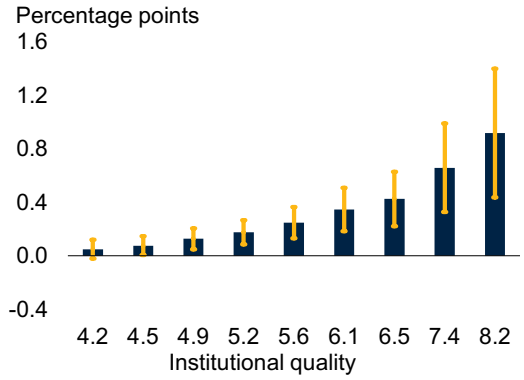
Table 3. Institutional quality and economic policy reform as drivers of the likelihood of investment accelerations (log odds)

	(1)	(2)	(3)
Lagged institutional quality (IQ)	0.205***	0.247***	0.272***
	(5.71)	(6.35)	(6.71)
Lagged log of capital to output ratio	-0.430***	-0.514***	-0.531***
	(-2.75)	(-3.20)	(-3.29)
Lagged undervaluation index	1.158***	1.229***	1.240***
	(6.76)	(6.79)	(6.91)
Lagged global GDP growth	0.130***	0.119**	0.115**
	(2.76)	(2.44)	(2.33)
Lagged capital inflows to GDP ratio	-0.010***	-0.011***	-0.011***
	(-4.24)	(-4.25)	(-4.18)
Lagged policy change variable (EPR)		0.010***	0.021***
		(2.63)	(4.18)
Interaction of lagged IQ and lagged EPR			0.011***
			(3.37)
Constant	-1.367***	-1.236***	-1.183***
	(-5.62)	(-4.93)	(-4.66)
Number of observations	2401	2329	2329
R2_p	0.041	0.047	0.052
Number of episodes	122	116	116
Number of countries	102	99	99

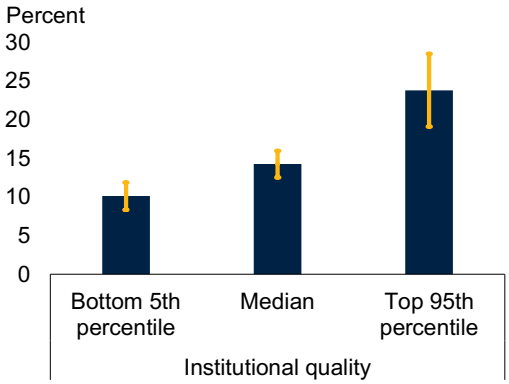
Notes: Dependent variable is a dummy variable equal to 1 in the year when an acceleration starts and +/- 1 year. Policy changes are calculated as the percent change in the policy index. T-statistics in parentheses, * p<0.10, ** p<0.05, *** p<0.01. The IQ and EPR variables have been demeaned.

Figure 4. Marginal effect of economic policy change at different levels of institutional quality

A. Marginal effect of a change in the policy index conditioning on the level of institutional quality



B. Predicted probability of starting an investment acceleration conditioning on the level of institutional quality



Notes: The panels are based on the regression results shown in Table 3. In panel A, bars show the estimated marginal effect of a change in the policy index over a 5-year period on the probability of starting an investment per capita acceleration episode at different levels of the institutional quality index (decile thresholds). Other variables are evaluated at the mean. Error bars show 95 percent confidence intervals. In panel B, bars show the predicted probability of starting an investment acceleration at different levels of institutional quality with all other variables evaluated at their sample mean (from 2014-2017) and how this probability would increase in the counter-factual case of increasing institutional quality to the median and top 5th percentile of the institutional quality distribution. Whiskers depict 95 percent confidence interval.

5. Robustness analysis

As a first step, we examine how sensitive our results are if we employ different indicators of IQ and EPR. Table 4 presents the outcomes. Column (1) shows the results using the ICRG "law and order" index as proxy for IQ and the change in trade restrictions from Alesina et al. (2020) as EPR. In column (2), EPR is proxied by changes in the Chinn-Ito capital account restrictions index, while in column (3) we employ the level of government debt as a proxy for the sustainability of fiscal policy. The coefficient of the latter variable is not significant, while the same holds for the interaction term of the debt ratio and IQ. The results for the other policy reform indicators are in line with the outcome of our base model, i.e., the impact of policy reform on the probability of an investment acceleration is conditional on the level of institutional quality.

Table 4. Institutional quality and economic policy reform as drivers of the likelihood of investment accelerations: alternative indicators (log odds)

	(1) Trade restrictions	(2) Capital account restrictions	(3) Debt to GDP ratio
Lagged institutional quality (IQ)	0.442***	0.242***	0.287***
	(6.13)	(4.32)	(4.31)
Lagged log of capital to output ratio	-0.324*	-0.353**	-0.539***
	(-1.74)	(-2.08)	(-2.80)
Lagged undervaluation index	1.517***	1.227***	1.250***
	(6.62)	(6.03)	(5.78)
Lagged global GDP growth	0.132**	0.205***	0.230***
	(2.14)	(3.50)	(3.60)
Lagged capital inflows to GDP ratio	-0.030***	-0.010***	-0.012***
	(-3.58)	(-3.68)	(-2.62)
Lagged policy change variable	0.012*	0.005***	-0.006
	(1.90)	(3.22)	(-0.70)
Interaction of lagged IQ and lagged policy change	0.014*	0.000	-0.000
	(1.96)	(0.42)	(-0.04)
Constant	-1.179***	-1.532***	-1.331***
	(-3.92)	(-5.47)	(-4.45)
Number of observations	1295	1711	1319
r2_p	0.074	0.052	0.059
Number of episodes	76	97	78
Number of countries	74	93	93

Note: Dependent variable is a dummy variable equal to 1 in the year when an acceleration starts and +/- 1 year. Institutional quality is proxied by the ICRG's law and order index. For the trade restrictions index and the Chinn-Ito index, policy changes are the annual percent change in the indexes, for the debt-to-GDP ratio, policy changes are the percentage point change in the ratio. T-statistics in parentheses, * p<0.10, ** p<0.05, *** p<0.01. The IQ and economic policy variables have been demeaned. Last observation for change in trade restrictions is for 2014.

Next, we check whether our results are robust to the use of alternative sets of episodes identified using different threshold and duration parameters as well as controlling for additional variables. The upper part of Table 5 shows the results if we rerun the main regression shown in Table 3 using investment accelerations identified when alternative minimum duration length is required while holding the minimum required growth rate of 4 percent constant. The lower part of Table 5 presents the outcomes when using alternative minimum average investment requirements while keeping the baseline minimum duration length. It turns out that the main findings are robust to using different parameters to identify investment growth accelerations.

Table 5. Institutional quality and economic policy reform as drivers of the likelihood of investment accelerations: different filter parameters (log odds)

	(1) Minimum duration of 5 years	(2) Minimum duration of 7 years
Lagged institutional quality (IQ)	0.320***	0.348***
	(8.46)	(7.52)
Lagged policy change variable (EPR)	0.018***	0.024***
	(3.85)	(4.55)
Interaction of lagged IQ and lagged EPR	0.007**	0.015***
	(2.21)	(4.11)
Episodes	140	85
Countries	100	99
	(3) Minimum growth rate of 3 percent	(4) Minimum growth rate of 5 percent
Lagged institutional quality (IQ)	0.361***	0.172***
	(9.56)	(3.89)
Lagged policy change variable (EPR)	0.017***	0.026***
	(3.67)	(4.64)
Interaction of lagged IQ and lagged EPR	0.009***	0.014***
	(2.86)	(3.63)
Episodes	128	92
Countries	99	99

Notes: Dependent variable is a dummy variable equal to 1 in the year when an acceleration starts and +/- 1 year. Policy changes are calculated as the percent change in the policy index. T-statistics in parentheses, * p<0.10, ** p<0.05, *** p<0.01. The IQ and EPR variables have been demeaned. The same covariates that are included in column (3) in Table 3 are included here but not shown for simplicity.

Table 6 offers the estimation outcomes adding the following additional control variables in the baseline regression: income per capita[16]; lagged per capita investment growth, the global recession year dummies defined in Kose et al. (2020), the global financial cycle factor provided by Miranda-Agrippino and Rey (2020), and natural resource rents as a share of GDP (taken from the World Development Indicators). Across all robustness tests, the baseline results presented in Table 3 do not change in a meaningful way.

[16] We add this control variable to check whether our results are driven by the high correlation between real GDP per capita and institutional quality.

Table 6. Institutional quality and economic policy reform as drivers of the likelihood of investment accelerations: additional controls (log odds)

	(1)	(2)	(3)	(4)	(5)
Lagged institutional quality	0.252***	0.277***	0.270***	0.302***	0.284***
(IQ)	(4.86)	(6.80)	(6.66)	(7.21)	(6.66)
Lagged policy change	0.021***	0.022***	0.021***	0.019***	0.023***
variable (EPR)	(4.19)	(4.40)	(4.18)	(3.62)	(4.54)
Interaction of lagged IQ	0.011***	0.012***	0.011***	0.009***	0.012***
and lagged EPR	(3.37)	(3.48)	(3.39)	(2.71)	(3.46)
Lagged output per capita	0.047				
	(0.52)				
Lagged per capita		-0.014***			
investment growth		(-3.28)			
Global recession dummy			-0.352		
			(-1.28)		
Global financial cycle factor				-0.054	
				(-0.67)	
Natural resource rents (share					0.006
GDP)					(0.75)
Number of observations	2329	2329	2329	2224	2298
r2_p	0.052	0.056	0.052	0.053	0.054
Number of episodes	116	116	116	113	114
Number of countries	99	99	99	99	99

Notes: Dependent variable is a dummy variable equal to 1 in the year when an acceleration starts and +/- 1 year. Policy changes are calculated as the percent change in the policy index. T-statistics in parentheses, * p<0.10, ** p<0.05, *** p<0.01. The IQ and EPR variables have been demeaned. The same covariates that are included in column (3) in Table 3 are included here but not shown for simplicity.

Finally, we have added some variables to take duration dependence into account. Following Mirau et al. (2007), this problem can be explained as follows. It is well known that variables in a panel model are likely to be temporally dependent, in which case ordinary logit (or probit) models may result in overly optimistic inferences (too high t-statistics). Beck et al. (1998) show that panel logit data are identical to grouped duration data and suggest dealing with this problem by adding a series of dummy variables to the model marking the number of years since the previous occurrence of an "event" (in our case an investment acceleration). An important drawback of this solution is that a lot of degrees of freedom are lost due to the large number of dummy variables. As a solution, Beck et al. (1998) suggest replacing the dummy variables with a smooth function based on cubic splines. We also follow another suggestion of Beck et al. by including the number of accelerations in the past. Again, this is necessary since standard logit

models assume that the adjustments are independent from one another, which is obviously not true. The results as reported in Table 7 suggest that our results remain fairly similar when we take duration dependence into account.

Table 7. Duration dependence

	(1) Dummies for duration	(2) Spline function
Lagged institutional quality (IQ)	0.297***	0.272***
	(6.55)	(6.34)
Lagged policy change variable (EPR)	0.020***	0.018***
	(3.27)	(3.33)
Interaction of lagged IQ and lagged EPR	0.011***	0.010***
	(2.69)	(2.72)
Number of observations	1920	2316
r2_p	0.107	0.074
Number of episodes	111	111
Number of countries	97	99

Notes: Dependent variable is a dummy variable equal to 1 in the year when an acceleration starts and +/- 1 year. Policy changes are calculated as the percent change in the policy index. T-statistics in parentheses, * p<0.10, ** p<0.05, *** p<0.01. The IQ and EPR variables have been demeaned. Column 1 includes 62 dummies capturing time since the last acceleration. Column 2 includes a cubic spline function based on the duration dummies, following Beck et al. (1998). The same covariates that are included in column (3) in Table 3 are included here but not shown for simplicity.

6. Conclusions

We have addressed two research questions. First: what are the key characteristics of investment accelerations? Second: what drives investment accelerations? In particular, we analyze whether investment accelerations are related to institutional quality and policy reform.

We propose a new filter to identify investment accelerations. This filter differs in two key dimensions from previous filters used for identifying growth accelerations. First, previous studies on accelerations typically adopt an eight-year framework without adapting to the volatile nature of investment growth. Second, the values for various criteria of our filter are taken from sample statistics, while previous studies used ad-hoc values (for instance, Hausmann et al. 2005; Jong-A-Pin and de Haan, 2011). We identify 192 investment accelerations in 93 economies (34 advanced economies and 59 emerging and developing economies) over 1950-2022.

Our evidence suggests that economic policy reform and institutional quality are important drivers of the likelihood that such an acceleration occurs. Furthermore, we find that

the impact of policy reform on the likelihood that an investment growth acceleration starts is conditioned by institutional quality.

Our study has limitations. Probably the most important one is that our paper, like all previous work in this line of research, does not take volatility differences across countries into account. Although we have tried to make sure that our identification strategy for investment growth accelerations does not pick up investment recoveries, it suffers from the critique that one size may not fit all, due to differences in the volatility of investment. The same critique has been raised by Wiese et al. (2018) on the literature identifying fiscal policy adjustments. These authors show that taking volatility differences in fiscal policy into account makes a difference: whereas most previous studies suggest that fiscal adjustments based on tax increases are unlikely to be successful, this no longer holds once the volatility of fiscal policy is taken up. A suggestion for future research is therefore to consider investment volatility differences in identifying investment growth accelerations. Another suggestion for future research is to consider alternative means to take duration dependence into account, for instance, by employing duration models. Furthermore, it would be useful to distinguish between private and public investment accelerations. This could perhaps shed new light on the size of public investment multipliers (see Saccone et al. (2022) for a discussion). The experience of Ethiopia suggests that public investment may play an important role in initiating growth accelerations (Moller and Wacker, 2017). Lastly, studying investment decelerations may also bring us important policy lessons.

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Online material

Appendix 1. Details of growth and investment accelerations

Table A1. Starting and end years of investment growth accelerations

Economy:	ISO3:	Acceleration years:
Albania	ALB	1999-2009
Argentina	ARG	1967-1972
Armenia	ARM	1997-2008
Australia	AUS	2001-2007
Austria	AUT	1969-1974; 1986-1992
Belgium	BEL	1960-1970; 1984-1990; 2003-2008
Benin	BEN	1966-1972
Burkina Faso	BFA	1968-1974; 2002-2013; 2017-2022
Bulgaria	BGR	1994-2008
Bahrain	BHR	2012-2018
Belarus	BLR	1999-2011
Belize	BLZ	1986-1993
Bolivia	BOL	2005-2018
Brazil	BRA	1968-1976; 2005-2013
Botswana	BWA	1996-2007
Canada	CAN	1961-1966; 1984-1989; 1996-2008
Switzerland	CHE	1968-1973; 1977-1984
Chile	CHL	1977-1982; 1986-1993; 2002-2008
China	CHN	1977-1988; 1991-2022
Colombia	COL	2001-2007
Costa Rica	CRI	1973-1979; 1983-1990; 2004-2012
Cyprus	CYP	1976-1981; 2001-2008
Czechia	CZE	2002-2008; 2014-2019
Germany	DEU	1987-1992
Denmark	DNK	1983-1988; 1994-2000; 2013-2022
Dominican Republic	DOM	1970-1975; 2005-2010; 2014-2019
Algeria	DZA	1973-1978; 1999-2018
Ecuador	ECU	2007-2014
Spain	ESP	1960-1969; 1985-1991; 1994-2007; 2014-2019
Estonia	EST	1996-2007
Finland	FIN	1968-1975; 1995-2001

Table A1 continued		
Economy:	**ISO3:**	**Acceleration years:**
France	FRA	1985-1990
United Kingdom	GBR	1959-1964; 1983-1989
Equatorial Guinea	GNQ	1994-2001
Greece	GRC	1959-1965; 1995-2001
China, Hong Kong SAR	HKG	1970-1982; 1986-1994
Honduras	HND	2003-2008
Croatia	HRV	2002-2008; 2015-2022
Hungary	HUN	1993-2008; 2013-2019
Indonesia	IDN	1987-1997; 2003-2019
India	IND	1985-1990; 1994-1999; 2004-2012
Ireland	IRL	1967-1973; 1994-2006
Iran	IRN	1963-1968; 1999-2005
Israel	ISR	1986-1997; 2006-2013
Italy	ITA	1966-1974; 1997-2002; 2017-2022
Jamaica	JAM	1966-1971
Japan	JPN	1956-1973; 1984-1991
Kenya	KEN	2007-2012
Cambodia	KHM	2011-2019
Republic of Korea	KOR	1985-1996; 1999-2007; 2013-2018
Kuwait	KWT	1990-1996; 2001-2008; 2012-2018
Sri Lanka	LKA	1974-1980; 1990-1998; 2002-2013
Lithuania	LTU	2002-2007; 2010-2022
Latvia	LVA	1997-2007; 2017-2022
Morocco	MAR	1996-2009
Mexico	MEX	1991-2000; 2003-2008
North Macedonia	MKD	2006-2017
Mali	MLI	1971-1978; 1984-1991; 1992-1997; 2002-2008; 2014-2019
Malta	MLT	1963-1977; 1989-1995
Mongolia	MNG	1976-1982; 2005-2012
Mozambique	MOZ	2007-2014
Mauritius	MUS	1972-1978; 1983-1988

Table A1 continued		
Economy:	**ISO3:**	**Acceleration years:**
Malaysia	MYS	1967-1974; 1978-1983; 1988-1997; 2006-2018
Namibia	NAM	2005-2010
Nigeria	NGA	1969-1977
Nicaragua	NIC	1961-1966; 2010-2017
Netherlands	NLD	1963-1968; 1985-1990; 1994-2001
Norway	NOR	1963-1968; 1994-1999; 2003-2008
Nepal	NPL	2014-2019
New Zealand	NZL	1980-1985; 1993-1999; 2001-2007; 2010-2019
Oman	OMN	2002-2008
Panama	PAN	1965-1972; 1990-1995; 2005-2017
Peru	PER	1961-1966; 1969-1974; 1992-1997; 2002-2008
Philippines	PHL	1973-1983; 2012-2019
Poland	POL	1983-1988; 1992-2000; 2003-2008; 2017-2022
Portugal	PRT	1956-1961; 1967-1973; 1986-1992; 1994-2001; 2014-2019
Paraguay	PRY	1971-1981; 2005-2011; 2016-2022
Romania	ROU	1969-1975; 1999-2008; 2014-2022
Rwanda	RWA	1970-1975; 2002-2016
Saudi Arabia	SAU	2003-2008
Singapore	SGP	1966-1984; 1990-1997; 2005-2017
El Salvador	SLV	1970-1975; 1984-1989; 1991-2003; 2017-2022
Slovakia	SVK	2004-2011; 2014-2019
Slovenia	SVN	1996-2001
Sweden	SWE	1994-2007
Togo	TGO	1974-1979
Thailand	THA	1958-1970; 1976-1981; 1987-1996; 2001-2008
Türkiye	TUR	1969-1976; 2003-2008; 2010-2017
Tanzania	TZA	2002-2008
Uganda	UGA	1993-2012
Uruguay	URY	1974-1980; 1991-1998; 2004-2014
United States	USA	1983-1988; 1993-2000
Viet Nam	VNM	2002-2010; 2013-2022

Appendix 2. Data used.

The Fraser Institute (FI) data are available with annual frequency starting in 2001. Before that year, data are available at a 5-year frequency. In that case, we compute the change in the subcategories referring to policy (i.e., all FI subcategories except for the second) as follows. We compute 5-year changes and then use that computed change from t-2 to t+2. For instance, if we have data for 1970 and 1975, we compute the change from 1970 to 1975 and apply this value in 1973, 1974, 1975, 1976, and 1977. For institutional quality, we use the value at the beginning of the period. So, for the years of 1970-1974 we use the 1970 value.

Table A2. Control variables: description, expected sign, and sources.

Variable:	**Description:**	**Expected sign:**	**Source:**
Log of capital stock/GDP	Capital stock as a share of GDP	-	PWT10.01
Undervaluation of the exchange rate	Log of undervaluation index following Rodrik (2008)	+	PWT10.01
Global GDP growth	Weighted average of global GDP growth, following the *Global Economic Prospects* methodology	+	PWT10.01
Change in trade openness	Annual percent change in index of trade restrictiveness, between 0 (fully restricted) and 1 (fully unrestricted)	+/-	Alesina et al. (2020)
Change in debt to GDP ratio	Annual percentage point change in government debt to GDP ratio	-	Fiscal space companion website of Kose et al. (2022)
Change in capital account openness	Annual percent change in normalized Chinn-Ito index between 0 and 1	+	Companion website of Chinn and Ito (2006).
ICRG Law and order index	Law and order subcomponent of ICRG	+	PRS Group, ICRG data
Institutional quality (IQ)	Second component of Fraser Institute Index	+	Fraser Institute
Change in economic policy reform (EPR)	Five-year change of average of FI components 1,3,4, and 5.	+	Fraser Institute
Natural resource rents as share of GDP	Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.	+	WDI
Global financial cycle factor	A single global factor that explains an important share of the variation of risky asset prices around the world	+	Miranda-Agrippino and Rey (2020)
Dummy for global recessions	Global recessions occurred in 1975, 1982, 1991, 2009, and 2020	-	Kose et al. (2020)
Per capita investment growth		+	PWT 10.01

Table A3. Correlations among the RHS variables

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	Institutional quality (IQ)	Change in economic policy reform (EPR)	ICRG Law and Order	Undervaluation of the exchange rate	Log of capital stock/GDP	Change in trade openness	Change in capital account openness	Change in government debt	Global GDP growth	Net capital inflows
Institutional quality (IQ)	1									
Change in economic policy reform (EPR)	-0.3156	1								
ICRG Law and Order	0.811	-0.1118	1							
Undervaluation of the exchange rate	-0.6394	0.0652	-0.5832	1						
Log of capital stock/GDP	0.3434	0.0879	0.362	-0.2434	1					
Change in trade openness	-0.065	0.0678	0.0019	0.0652	-0.0028	1				
Change in capital account openness	-0.0702	0.1636	-0.023	-0.0513	-0.0005	0.0047	1			
Change in government debt	0.1345	-0.046	0.1169	-0.1349	0.1345	-0.1122	0.0538	1		
Global GDP growth	-0.0395	0.1051	0.0023	0.0135	-0.0281	0.0303	0.0289	-0.2089	1	
Net capital inflows	0.292	-0.0761	0.2288	-0.12	0.1367	-0.0402	-0.0222	-0.0517	0.142	1