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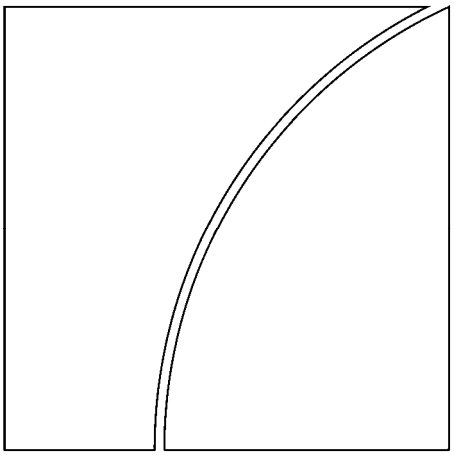

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Chronicle of Currency Collapses: Re-examining the Effects on Output

Matthieu Bussière, Sweta C. Saxena and Camilo E. Tovar[1]

Abstract

The impact of currency collapses (ie large nominal depreciations or devaluations) on real output remains unsettled in the empirical macroeconomic literature. This paper provides new empirical evidence on this relationship using a dataset for 108 emerging and developing economies for the period 1960-2006. We provide estimates of how these episodes affect growth and output trend. Our main finding is that currency collapses are associated with a permanent output loss relative to trend, which is estimated to range between 2% and 6% of GDP. However, we show that such losses tend to materialise before the drop in the value of the currency, which suggests that the costs of a currency crash largely stem from the factors leading to it. Taken on its own (ie ceteris paribus) we find that currency collapses tend to have a positive effect on output. More generally, we also find that the likelihood of a positive growth rate in the year of the collapse is over two times more likely than a contraction; and that positive growth rates in the years that follow such episodes are the norm. Finally, we show that the persistence of the crash matters, ie one-time events induce exchange rate and output dynamics that differ from consecutive episodes.

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Key words: currency crisis, nominal devaluations, nominal depreciations, exchange rates, real output growth, recovery from crises.

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Contents

1. Introduction

The recent global crisis placed currencies across the world under severe pressure. The Mexican peso jumped from 9.9 pesos per US dollar in August 2008 to nearly 14.4 pesos per US dollar in February 2009, a 46% depreciation rate in a matter of just six months. At about the same time, the Korean won jumped from just above a thousand wons per US dollar in July 2008 to nearly 1500 wons per US dollar in November 2008, a 50% depreciation rate in just four months. Such large swings in the value of these currencies vis-à-vis the US dollar are recent examples of a recurring phenomenon across advanced and developing economies over the past fifty years.

Public authorities tend to resist sharp currency collapses (ie large currency devaluations and/or depreciations), [2] presumably because they fear that they would be very costly in terms of foregone output. However, it is unclear how these events affect a country's economic activity as measured by GDP. The literature has examined the issue from different -and not always comprehensive- perspectives. For instance, there is a vast theoretical and empirical literature examining factors and shocks behind currency collapses as summarised by first, second, and third generation models of currency crises, models of sovereign default, models of sudden stops or by the empirical work on early warning indicators of currency crises.[3] Theory has also identified specific channels through which such events affect output, eg the expenditure switching effect, export competitiveness or the balance sheet channel -when agents face currency mismatches- just to mention a few (see Agénor and Montiel (1999), Krugman and Taylor (1978), Burstein et al. (2007 and 2005) or Tovar (2005)). However, the literature has put much less attention to what happens to output after a currency collapse, a phenomenon that we will also refer to as a currency crash. In fact, there is no systematic study examining the dynamics of this relationship at different time horizons and, to our knowledge, no study explicitly quantifies the impact of these events on output trend. Key exceptions include Gupta et al. (2007), Hong and Tornell (2005), and Hutchison and Noy (2002), but all these studies tend to focus on short-term dynamics.[4] In general, the effect of currency collapses on output remains largely unsettled in the empirical macroeconomic literature.

The objective of this paper is to revisit the relationship between currency collapses and GDP. Given the complexity of the issue, we only aim at addressing the following questions. Conditional on a currency crash, i) what are the output dynamics in the short-, medium- and long-run?; and ii) how robust is this relationship over time, across regions and exchange rate regimes? As such, the paper aims at identifying empirical regularities on currency collapses, which future research can build upon. From a policy perspective, these stylised facts also provide important information on the recovery from currency collapses, which can help policy makers improve the output dynamics after the event. In general, the goal is modest, to the

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[2] Unless otherwise stated, large losses in the value of a currency vis-à-vis the US dollar (ie large devaluations and or depreciations) will be referred to as currency collapses or currency crashes, indistinctively. The paper explores in one of the specifications the distinction between different exchange rate arrangements (eg pegs, floats, or other intermediate arrangements).

[3] For an empirical evaluation of early warning indicators of currency crises see Bussière and Fratzscher (2006); Berg et al. (2005); or Berg and Pattillo (1999). For a summary of theoretical and empirical contributions of currency crises in emerging economies see Agénor and Montiel (2008).

[4] We refer to contributions with large sample sizes. An important contribution is Edwards (1989); see also Agénor and Montiel (1999) for a review of earlier literature.

extent that we do not aim at identifying the shocks determining the currency crash, or the specific channels involved, which can change substantially from episode to episode.[5]

Unlike most of the existing literature, this paper employs a large dataset that spans nearly 50 years across a broad set of countries. More precisely, we rely on a panel of 108 emerging and developing economies for the period 1960-2006. As such, we avoid selection bias problems often found in the literature, which are associated with the use of small cross-section or short time series samples.

To assess the dynamics of output around a currency collapse we employ four complementary methodologies, each of which aims at addressing specific aspects of the issue at hand. In doing so, we split the episodes on the basis of the currency collapse being a stand alone incident or one that repeats itself over time. *First*, we use *conditional probabilities* to determine whether expansionary devaluations or depreciations are more likely than contractionary ones, and whether initial business cycle conditions matter or not. These probabilities represent a convenient way of synthesising the information on output growth, while conditioning on various events. To our knowledge, this is the first time that results are presented using this technique. *Second*, to get a sense of the short- and medium-run behaviour of exchange rates and output around the time of a currency crash we perform *event case analyses*. *Third*, to complement the previous analyses, we employ a *two-way fixed effects panel regression,* as in Forbes (2002), and take it a step further by using the econometric results to simulate the deviations of output from its trend. The analysis is relevant to the extent that it provides a basis to compare the short- and medium-term impact of such episodes vis-à-vis a control group (ie countries where no large currency collapses occur); and allows us to identify whether such episodes can be associated with permanent gains or losses relative to trend. *Finally*, to assess, *ceteris paribus*, the full impact of a currency crash on the level of output (from the short- to the long-run) we employ a *dynamic panel analysis* that follows Cerra and Saxena (2008) and Romer and Romer (1989).

Our analysis explicitly takes into account two points not usually considered in the literature. (i) the short- and long-run effects of currency collapses on output are likely to differ;[6] (ii) a persistent currency collapse (ie consecutive devaluations or depreciations) is likely to have a different impact on output than one-time episodes.

Our main finding is that currency collapses are associated with permanent losses in real GDP. According to our estimates the level of GDP is between 2% to 6% lower three years after a currency collapse than otherwise. However, these losses tend to materialise *before* the currency collapse. This means that the economic costs do not arise from the depreciation/devaluation per se, but rather reflect other factors. Indeed, the currency collapse itself is found to have a *positive* effect on output. More generally, our results indicate that i) output growth tends to slow down prior to and in the year of the currency collapse; ii) the likelihood of a positive growth rate in the year of the collapse is over two times more likely than a contraction; iii) positive growth rates in the years that follow currency collapse episodes are the norm; and finally, iv) the persistence of the crash matters, ie one-time events induce exchange rate and output dynamics that differ from consecutive episodes.

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[5] These issues are not irrelevant. In fact, different shocks may induce divergent output dynamics (see Tovar (2005)), different channels may be involved, and their relative importance may change over time. Given their complexity, some of these complementary questions are left for future research.

[6] For example, the price elasticity of nominal trade flows is lower in the short- than in the long-run (it actually switches signs for imports: import values first rise due to higher prices, and subsequently decline as real imports fall). Hence, devaluations could deteriorate the trade balance in the short-run before improving in the long-run (J-curve effect). This would produce a lower growth in the short-run and higher in the long-run.

The robustness of our results is assessed in different dimensions. First, the estimates are examined by sub-periods and by regions. Second, the role of alternative "de facto" exchange rate regimes, as classified by Reinhart and Rogoff (2004), is evaluated. We find that full-sample results are sensitive to sample breakdowns. Indeed, results differ somewhat across regions, and there is evidence that the currency collapse–output relationship has shifted over time. For example, the output slowdown associated with currency collapses seen prior to or at the time of the currency collapse in the full sample is mainly driven by events occurring after the 1980s, and is also mainly associated with Asia and Latin America. The sensitivity of results provides an explanation for the wide variety of findings reported in the literature. In addition, they are more or less expected. For instance, it is intuitive to expect the relative importance of different transmission channels to change over time (eg due to changes in the financial and institutional environment). Lastly, our results also indicate that, contrary to common perception, the likelihood of currency crashes does not depend on the exchange rate regime in place.

The remainder of the paper is structured as follows. Section 2 reviews the empirical literature examining the link between currency collapses and output. Section 3 defines a currency collapse. Section 4 presents some stylised facts of currency collapses and presents a preliminary analysis of output dynamics in countries that experience such crashes. Section 5 complements the analysis with econometric evidence and simulations aimed at capturing the impact on output around the time of a currency collapse and its impact on output trend, while taking into account a control group. Section 6 examines the robustness of results across different dimensions: regional, time, and exchange rate regimes. A final section concludes.

2. Review of the empirical literature

2.1 Preliminary considerations

Reviewing the empirical literature that examines the relationship between currency collapses and output is complex for several reasons. *First*, there is no unified treatment for defining the relevant currency episodes under consideration. As a matter of fact, not all studies focus on currency collapses per se. Furthermore, defining what we mean by a "collapse" or "crash" involves a certain degree of arbitrariness. This is evident when we consider that, in his classical paper, Cooper (1971) defined a large currency devaluation as any episode in which the annual exchange rate change exceeded 10%. Such a definition, in high inflation environments as those seen during the 1970s and 1980s, would have led to the identification of a currency crisis episode every single month (Frankel (2005)). For this reason, more recent studies have employed alternative criteria; say, by including not just the variation in the exchange rate, but also the acceleration in the exchange rate change and its initial level. Equally important is that studies differ on whether the explanatory variable is the nominal or the real exchange rate change. Certainly, not all nominal currency collapses translate into significant changes in the real exchange rate. However, the empirical evidence does support that nominal devaluations, more often than not, lead to real devaluations (see Bahmani-Oskooee and Miteza (2002) for developing countries).[7] The task of comparing currency collapses with currency crisis episodes is further complicated when the latter event is identified by a combination of variables, such as the magnitude of the exchange rate change, changes in interest rates or changes in international reserves (eg as captured by exchange rate market pressure (EMP) indices). Adding more variables only increases the complexity

[7] This lends support to Goldfajn and Valdés (1999) statement that, in the last 35 years, policy makers in most countries have preferred to correct large real appreciations through nominal devaluations.

but does not necessarily improve the identification of crisis episodes. In this respect, it has been shown that the identification of currency crises episodes based on commonly applied EMP indices is highly sensitive to the choice of weighting schemes or the parametric assumptions used in the construction of thresholds (Potines and Siregar (2008)).

Second, the literature has also treated the impact on output in very diverse ways. While many studies employ real GDP growth rates in a given year (or quarter), others define the impact of currency collapses on output by comparing the difference between the average output growth some period after the crisis (eg the year of the crisis and the year after it) and some "tranquil" period prior to it (Gupta et al. (2007)), or only examine the average growth rate in the years that followed the event (Hong and Tornell (2005)). Aside from the arbitrariness of such an approach, its weakness is that the dynamics of the process is neglected, including any considerations about the persistence of the shock. Moreover, by doing so, many studies fail to establish a differentiated impact across the short-, medium- and long-run. Furthermore, using the difference of average post-crisis and pre-crisis growth rates as the dependent variable is by itself a source of *endogeneity bias* (Hong and Tornell (2005)).

Finally, existing studies are susceptible to selection bias, either due to a small sample of countries, a short sample period or the use of cross-sectional data (which precludes the use of a control group). As a result, a wide variety of statistical and econometric methods has been employed, creating additional hurdles for the comparison of results. Nonetheless, it is also important to highlight that clustering the analysis may be reasonable. But even then, it is uncommon to find in the literature a clustering of the analysis based on theory, for example, aimed at identifying the role of particular transmission channels. In this respect, possibly the main exception is the paper by Kaminsky (2006).

2.2 Expansionary or contractionary currency collapses?

A significant number of studies for developing and emerging market economies (EMEs) find a contractionary impact of currency collapses on output (see Edwards (1989) and Morley (1992)). Edwards (1989) finds a contemporaneous contractionary effect associated to these events in developing countries and EMEs, a result echoed in Hutchison and Noy (2002). However, Edwards also finds an expansionary effect the year after the crisis.

Other studies have looked at the dynamics of output around currency crises. For example, Milesi-Ferretti and Razin (1998) find that output during the year of the crisis is lower than the average during the three-year period preceding and following the crisis (V-shape).[8] They also find that the strongest predictor of output growth after a crisis is the average growth rate behaviour before the crisis. That is, there appears to be a "continuity" effect on output behaviour, which points out to a potential selection bias problem associated with the fact that countries devalue their currencies after entering a recession. However, such results differ from those reported by Gupta et al. (2007), who find that contractionary episodes are negatively correlated with a business cycle indicator, that is, recessions are worse if they follow an economic boom. They also report that large capital inflows prior to the crisis exacerbate output losses, although capital controls put in place prior to the crisis can dampen such adverse effects, that competitive devaluations also increase output losses, while export growth and trade openness may stimulate the recovery. In a related study, Hutchison and Noy (2002) find that contractionary effects are associated with real exchange rate overvaluation, slow growth of trading partners and substantial losses in international reserves.

[8] They identify crises by different measures that involve the level, acceleration, and past levels of devaluation rates.

The contractionary effects of currency crises have been qualified by testing the importance of some transmission channels, such as the balance sheet effect or the impact of financial dollarisation. For instance, Cavallo et al. (2002) find that currency devaluations in the presence of large foreign currency liabilities can increase the value of debt relative to revenues, crippling insufficiently hedged debtors and leading to business failures and output contractions. Bebczuk et al. (2007) find that devaluations are contractionary once dollarisation is controlled for. However, Céspedes (2005) finds that contractionary balance sheet effects from real exchange rate devaluations only operate in the short-run. In the medium term they have expansionary effects.[9]

Nonetheless, the contractionary relationship between currency collapses and output is not as robust as suggested in the literature surveyed so far.[10] Gupta et al. (2007) report that in a cross-section of 195 crises episodes in 91 developing countries from 1970-2000, contractionary and expansionary episodes tend to occur with almost the same frequency.[11] Furthermore, they find that "[…] *there is no distinct change in the pattern of growth during crises in the 1970s, 1980s and 1990s*" (pp 435). However, the lack of a control group may be biasing their results. Using a data set of 155 countries for the period 1970-1999 with 264 devaluation episodes, Magendzo (2002) finds that the contractionary effect of currency devaluations vanishes once selection bias is taken care of. Indeed, using alternative definitions of devaluations and employing matching estimators to generate a control group, he concludes that "[…] *results are robust: devaluations show no statistically significant effect on output growth*".[12]

The literature is also inconclusive regarding the stability of the relationship over time or across regions. On the one hand, Gupta et al. (2007) find a split expansionary/contractionary pattern that is stable across the three decades covered in their study. On the other hand, Kim and Ying (2007) find evidence of contractionary devaluations in Asia after 1998, but expansionary effects for the pre-1997 period. Nonetheless, they find a persistent contractionary relationship for Chile and Mexico. This is not surprising as it seems reasonable to expect changes in factors involved in the transmission channel over time. For instance, in recent years there have been changes in the degree of exchange rate pass-through to inflation, currency exposures (thus affecting the relevance of the balance sheet effect), and the exchange rate regimes in place.[13] The impact may have also changed with financial deepening or as some countries de-dollarise their economies (Céspedes (2005) and Bebczuk et al. (2007)).

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9 The importance of alternative features of exchange rate behaviour has also been explored. For example, Chou and Chao (2001) find that devaluations have no effect on output for five Asian countries, but exchange rate volatility has a negative impact on output growth in the short-run.

10 See also the survey on the literature by Agénor and Montiel (1999).

11 The definition of currency crisis used in their study is based on episodes identified by four other studies to which they apply a simple majority rule. We do not find this approach desirable. By combining definitions that involve different components their study is in some sense intractable.

12 Hutchison and Noy (2002) try to control for a different selection bias problem: countries that experience a currency crises may be different in other respects from non-crises countries and episodes. In other words, they suggest that other factors contributing to the crises are causing the sample selection bias. To test for this possibility, they construct the inverse mills ratio statistic from a probit regression for crises episodes, and add it as an additional regressor in the output growth regressions. However, their statistic turns out to be statistically insignificant.

13 For instance, as economies become financially more open, firms can easily get exposed to currency mismatches, thus becoming vulnerable to currency collapses in a manner that was not possible in previous decades, when economies were less financially integrated.

The lack of robust results in the literature is not exclusive to EMEs. In fact, split expansionary and contractionary patterns have been reported for developed economies. Focusing on 23 OECD countries, Kalyoncu et al. (2008) find that real depreciations are contractionary in the long-run in six countries and expansionary in three; and fail to find evidence of a long-run effect on output in the remaining countries. In contrast, Ahmed et al. (2002) compare devaluation episodes across a group of developing and industrial economies, where industrial economies are split according to their exchange rate regime.[14] They find that for industrial countries both, devaluations and depreciations, are expansionary, while for developing countries devaluations are contractionary.

While an important branch of literature examines the causes behind currency collapses (Bussière and Fratzscher (2006); Berg et al. (2005); and Berg and Patillo (1999)) reduced form analyses may have trouble in identifying the sources of shocks.[15] With some few exceptions (eg Hutchison and Noy (2002)), the literature that controls for factors that determine a currency collapse has also been divorced from that examining the dynamics of output following such events. Possibly the difficulty to identify, even ex ante, the factors that may explain crises may have deterred researchers from attempting to identify and isolate the effects of shocks behind crises.

Finally, there is also a branch of literature that examines in a more general manner the relation between exchange rates and growth. Such literature examines not just currency collapses, but more generally the impact of small and large exchange rate fluctuations, the role of exchange rate misalignments on growth or the role of exchange rate regimes on growth (see the survey by Eichengreen (2008)). Its main conclusion is that undervalued currencies stimulate economic growth, especially for developing countries (eg Hausman et al. (2005) and Rodrik (2008)). The literature examining the impact of exchange rate regimes is less conclusive. Nonetheless a recent study by Dubas et al. (2010) concludes that stable-currency value regimes (eg fear of floating) tend to display higher growth.

3. Defining currency collapses

Defining a currency collapse is a matter of controversy as it involves a high degree of subjectivity. This is also an inherent problem of the currency crises literature, which has relied on different definitions. In defining these episodes, a common approach is to construct a weighted index based on exchange rate changes, the loss of international reserves and changes in interest rates. Although desirable, this approach is not pursued here, given that our main interest is related to the real effects of large currency collapses on output (in

[14] This allows them to consider differences between the effects of devaluation vis-à-vis depreciations.

[15] Structural models can help deal with this problem. For example, Tovar (2006 and 2005) estimates a dynamic stochastic general equilibrium (DSGE) model to assess the relative importance of different transmission channels through which currency devaluations may affect output. Considering a model with expansionary expenditure-switching and contractionary balance sheet effects built-in, he concludes that devaluations in Chile, Colombia, Korea, and Mexico have been expansionary despite the contractionary balance sheet effect , a result consistent with the dominance of the expenditure-switching over the balance sheet effect. Burstein et al. (2007 and 2005) have also looked into the impact of large exchange rate devaluations. Although their focus is the nominal exchange rate pass-through onto the real exchange, they do highlight that devaluations are often associated with negative wealth effects.

addition, the lack of data on interest rates for different countries and for a long time span would severely reduce the sample size).[16]

In what follows, three alternative definitions based on nominal exchange rate fluctuations are considered. This aims at providing transparent and robust results. The first two definitions follow Milesi-Ferretti and Razin (1998); the third is introduced to reduce some of the subjectivity in defining currency collapses.

3.1 General definitions of currency collapses

Let S_t be a country's nominal exchange rate, expressed as units of local currency per unit of a foreign currency (the US dollar).[17] Then, a *currency collapse* occurs at year t=T if there is any month (*m*) in a given calendar year (*t*), in which the annual change in the exchange rate exceeds a positive threshold value. Formally, $\Delta S_{m,t} = \left(\frac{S_{m,t}}{S_{m-12,t-1}} \right) - 1 > threshold > 0$, where the *threshold value* is identified by one of the following definitions:

Definition 1: A currency collapse occurs if the annual nominal exchange rate change, $\Delta S_{m,t}$, in any given month during a calendar year, satisfies the following three criteria:

a. The exchange rate change is at least 25 percent: $\Delta S_{m,t} \geq 0.25$

b. The exchange rate change at least doubles that of the previous year ie $\Delta S_{m,t} \geq 2 \cdot \Delta S_{m-12,t-1}$

c. The exchange rate change during the previous year does not exceed 40 percent. More precisely, $\Delta S_{m-12,t-1} \leq 0.4$

Definition 2: A *currency collapse* occurs if the annual nominal exchange rate change in any month during a given calendar year, $\Delta S_{m,t}$, satisfies the following three criteria:

a. The exchange rate change exceeds 15 percent: $\Delta S_{m,t} \geq 0.15$

b. The exchange rate change exceeds by at least 10 percent that of the previous year. Formally, $\Delta S_{m,t} \geq 1.1 \cdot \Delta S_{m-12,t-1}$

c. The exchange rate change in the previous year must not exceed 10 percent, that is $\Delta S_{m-12,t-1} \leq 0.1$

Definition 3: A large currency collapse occurs if the annual change in the exchange rate, in any given month during the calendar year, is in the top quartile of all the episodes in the

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[16] For this reason, Cerra and Saxena (2008) rely on a measure of this type that excludes interest rates to define currency crises. In the present paper we are specifically interested in large currency depreciations, not in failed speculative attacks.

[17] The nominal exchange rate is defined as the price of the local currency in terms of the US dollar. An alternative is to use nominal or real effective exchange rates. However since we aim at assembling a database with a large enough time span trade, weighting schemes would have severely restricted the sample size. Furthermore, using effective exchange rate measures in practice are not exempt of problems. For instance, Chinn (2006) reviews some of the difficulties and limitations with the weighting schemes involved in effective real exchange rate measures, and concludes that commonly used indices are often inadequate.

sample in which there is a relative loss in the currency value. Notice that to implement this definition we exclude appreciation episodes.

These definitions deserve three comments. First, definitions 1 and 2 explicitly consider the change and acceleration of the exchange rate change, as well as the initial level of the exchange rate. Second, definitions 1 and 2 differ in that the first one avoids capturing large currency fluctuations associated with episodes of high-inflation, while the second one focuses on episodes in which the exchange rate was relatively stable during the previous year. Third, one can order these definitions in terms of tightness: Definition 1 is more restrictive than Definition 2 by construction; in practice, Definition 3 is less restrictive than Definition 2. The definition that selects the largest number of episodes is therefore Definition 3, followed by Definition 2 and Definition 1.

3.2 Controlling for the persistence of currency collapses

Following the previous definitions we can now define events according to the persistence of the currency collapse. This allows us to examine the dynamics of output around the time of one or two consecutive collapses.

Event case 1 or one-time currency collapse: describes the average dynamics of output when a currency collapse occurs in a given year (*T*), and no collapse takes place within a three-year window before (*T-3, T-2, T-1*) and after the event (*T+1, T+2, T+3*).[18]

Event case 2 or persistent currency collapse: describes the dynamics of output when a large currency collapse occurs consecutively in two years (denote them by *T-1* and *T*), and no collapse occurs around a three-year window before (*T-4, T-3, T-2*) and after (*T+1, T+2, T+3*).

Alternative specifications of currency collapses were also considered.[19] However, the number of episodes fell considerably (less than ten in each case) making their analysis and any inference difficult.

The manner in which we have defined each event case allows us to capture explicitly the role of the persistence of a currency collapse over time. In this respect, *event case 1* is not contaminated by other nearby episodes, thus describing an episode with no persistence at all. By contrast, *event case 2* would explicitly incorporate into the analysis the role of the persistence of currency collapses.

Finally, a further advantage of using the definition for event case 1 is that it captures countries that have stable exchange rates before and after the currency crash. As such, it excludes episodes that could be driven by hyperinflation episodes or by other persistent macroeconomic imbalances, which could contaminate the effects on output.

4. Stylised facts of currency collapses and output behaviour

This section presents some stylised facts about currency collapses and output dynamics. We start by implementing the criteria discussed in the previous section to identify currency collapses. For this purpose we employ data for 108 countries from 1960-2006 (see

[18] The literature has traditionally used a three year window. Of course, once could explore the sensitivity of result to varying the window size. Nonetheless, this is possibly a second order issue.

[19] For instance, those occurring in three or four consecutive years and no devaluation occurring around a three-year moving window before and after the episode.

appendices A and *B* for data sources and a list of countries included in the study).[20] Next we examine the data using descriptive statistics, including conditional probabilities and statistical event case analysis.

4.1 Frequency and threshold values of currency collapses

The threshold values determining a currency collapse and the number of episodes identified under the three alternative definitions are reported in Table 1. Results are displayed for the full sample and by decades, regions, and exchange rate regimes; the latter as classified by Reinhart and Rogoff (2004) and updated more recently.[21] Full sample statistics show that *definition 3* (ie collapses in the top quartile of the sample) identifies by far the largest number of episodes, 571 in total. This definition is less restrictive than the alternative *definitions 1* and *2*, which capture fewer episodes (202 and 251, respectively).

Summary statistics also indicate that currency collapses occurred with greater frequency during the 1980s and 1990s (Table 1). Geographically, these events are more common in Africa, followed by Latin America. Although the number of episodes varies depending on the definition employed, the percentage of episodes occurring in each region is fairly stable across them.

Finally, we also examine whether currency collapses are related to the type of exchange rate regime in place. This addresses concerns of currency collapses being dominated by regime transitions, such as those caused by the collapse of a peg or some form of soft pegs.[22] The evidence reported in Table 1 shows that currency collapses are common across all exchange rate regimes. Nonetheless, they are particularly apparent in what Reinhart and Rogoff classify as "free falling" regimes. This is not surprising, in their classification this category includes exchange rate regimes in which the twelve-month inflation equals or exceeds 40 percent or in which there is a currency crisis as defined by a transition from a fixed (or quasi-fixed) regime to a managed or independently floating regime. The main point is that a significant portion of currency collapses occurs under all regimes, including countries with flexible exchange rate regimes in place.

In general, the threshold value for a currency collapse to occur is fairly stable across definitions, in particular, over time and regions, and to a lesser extent across exchange rate regimes. For these reasons, and to simplify the exposition, in the remaining of the paper we focus on *definition 3*, although we will also report some results for the alternative definitions. An advantage of focusing on *definition 3* is that it puts less emphasis on ad-hoc restrictive features. This is well illustrated, for instance, by the fact that *definition 1* would fail to capture an episode in which the exchange rate change at *T-1* and *T* were, say, 30% and 58%, respectively.

Finally, Table 1 also reports results using *definition 3* to select the episodes to be included in *event cases 1* and *2*, respectively. As shown, about 14% of the 571 episodes identified by

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[20] To deal with possible outliers we eliminate from our sample all countries for which we have less than ten years of usable observations. In addition, we drop those episodes in which the exchange rate devalued more than 600% or in which the change in output exceeded 20% in absolute value.

[21] For this purpose we employ the updated database published in Reinhart and Rogoff (2004) available at http://terpconnect.umd.edu/~creinhar/Papers.html. In particular, we rely on what they call the *coarse classification*. According to it, *exchange rate regimes* are split into six categories: currency boards and pegs, soft-pegs and crawling bands, managed floats, freely floating or flexible, free falling and missing data for dual markets to which we refer to as unclassified. For the purposes of our analyses, we take as reference the exchange rate regime in place at the time the first currency collapse occurs.

[22] See for instance the review by Osakwe and Schembri (2002 and 1998) who argue that the main cause of currency crises is a fixed nominal exchange rate.

definition 3 are one-time events in a three-year window before and after the episode, and only 4% can be considered consecutive episodes. Results also confirm that currency collapses occur when the exchange rate changes by a magnitude that is close to 20%. This result is robust to regional or exchange rate regime breakdowns.

4.2 Output behaviour around the time of currency collapses

4.2.1 Conditional probabilities

A preliminary assessment of output dynamics following a currency crash can be obtained, first, by calculating the frequency and median size of the expansion or contraction in output during the years that follow the event, and second, by examining the conditional probabilities of certain growth dynamics that take place after a currency collapse. Among the conditioning events we include expansionary or contractionary episodes in the years that follow a currency collapse and accelerating or decelerating growth episodes. This approach allows to answer questions, such as: i) how likely is it for a country to have an output expansion given that the economy experienced a currency collapse at *T* and output growth in that year was negative or positive?; ii) how likely is it for an economy to experience accelerating or decelerating growth rates in the years that follow a currency crash (ie $g_T < g_{T+1} < g_{T+2}$ or $g_T > g_{T+1} > g_{T+2}$); or finally, iii) how do the initial business cycle conditions (eg output expansion or contraction in the years prior to the collapse) influence output dynamics after a currency collapse.

We start by examining the frequency and the median growth rate of output expansions or contractions conditioning on having a currency collapse*;* Once the conditioning event has been defined we examine whether there was a positive or negative growth rate in the year or years following the collapse, ie *t=T ot t=T+1, T+2, etc*. Therefore in Tables 2 to 5 the horizontal rows determine the conditioning event and the columns depict the observed outcome after the event. The conditional probabilities reported include:[23] 1) a positive or negative growth the year after the currency collapse; 2) positive or negative growth rates during the two years that follow the currency crash; and 3) accelerating or decelerating growth dynamics during the two years after the crisis.

Our calculations show that the likelihood of observing positive output growth rates in the year of a collapse is over two times greater than during a recession (0.7 versus 0.3 in Table 2).[24] Also, there is a broadly symmetric behaviour between the median growth rate of an expansion and a contraction (4 percent versus -3 percent, respectively). In addition, the likelihood of experiencing positive growth rates in *T+1* is greater than observing a contraction independently of the initial conditions ie of whether the economy grew at *T* or not (0.84 in the case of an output expansion at time *T* and 0.62 in the case of an output contraction at time *T*). Next, economies with positive growth rates in *T* have a higher probability of remaining on a positive growth path in a one or two year horizon than those that had a recession in *T* (0.74 in case of an expansion and 0.49 in case of a contraction at time *T*); Finally, we find that it is

[23] Specifically, let *A* be the event in which there is a currency collapse and a positive or negative growth in *T* and N_A the number of episodes satisfying event *A*. Let *B* be the conditioning event, and N_B the number of episodes satisfying event *B*. Thus, we report the conditional probability, $P(A/B)= P(A \text{ and } B)/P(B)= N_{AB} / N_B$, where N_{AB} is the number of events satisfying event *A* and *B*.

[24] Note that the *unconditional* probability of observing a positive growth rate in the sample is, of course, higher, at above 85%. The fact that the *conditional* probability is lower already suggests that currency crashes have a negative effect on growth at the time of the crisis, as confirmed by the econometric analysis presented in Section 5.

unlikely for an economy to remain in a recession or get into a recessionary growth dynamics in the two years that follow a currency collapse.

Summarizing, two results stand out. First, growth developments tend to be somewhat less dramatic than expected (growth is positive in a significant number of instances), and second, the outcome seems to depend on the initial conditions, ie growth is more likely to be positive after the crash if the country was already growing beforehand.

We now modify the previous analysis to examine the possibility of experiencing accelerating or decelerating growth episodes once a currency collapse takes place, while controlling for initial *business cycle* conditions. In particular, we condition either on the output growth the year prior to the currency crash (g_{T-1}) or on the three-year average growth rate prior to the event taking place. Our calculations show three noticeable features (Table 3). First, an economy is more likely to experience in the short- and medium-run accelerating growth dynamics when the economy has been growing prior to the currency collapse, than when the economy has been in a recession. Second, an economy has just over fifty percent chance of displaying positive growth at *T* if the currency collapse occurred following a recession. However, in such cases the median growth rate at *T* is almost the same (3.8%) as the median growth rate observed in economies that were already expanding prior to the currency collapse (4.0%). Finally, accelerating growth dynamics are more likely to occur if the currency crash takes place following an expansion.

Similar calculations are reported in Tables 4 and 5, but now we restrict the analysis to a one-time currency collapse (e*vent case 1*).[25] Table 4 confirms that the likelihood of observing positive growth rates in the year of the collapse is very high, nearly three times greater than observing a recession (0.73 vs. 0.27). In addition, we identify a reinforcing growth effect in those economies that displayed positive growth rates in *T*. Indeed, these economies have a high positive growth probability in *T+1* (0.88). In such cases, the likelihood of observing accelerating growth in *T+1* is also high, but falls rapidly over the medium term, ie in *T+2* (0.24). Evidence also confirms that accelerating episodes are more likely to occur if the currency collapse took place after an expansionary period rather than during a recession (Table 5).

Therefore, our analysis of transition probabilities suggests that expansionary episodes at the time of a currency collapse are at least two times more probable than contractionary ones; that the economy is more likely to witness sustained growth if the currency collapse occurs following an expansionary cycle; and finally, that accelerating episodes are quite likely to happen if the currency collapse is a one-time event.

4.2.2 Event case analysis

We now examine the average time series of output and exchange rates around the time of a currency collapse (Figure 1). To get a sense of the distribution, the 25 and 75 percentiles are also plotted.

The output growth dynamics for *event case 1* follows an s-type pattern (Figure 1, upper-left panel): on average growth slows down prior to the currency collapse, moderately picks up at the time of the currency crash and accelerates afterwards. Notice that *growth rates a year to three years after the episode are on average higher than one or two years before the event*.

Regarding the exchange rate dynamics, we find that on average the currency falls by more than 50% during a collapse (upper right-hand panel), with devaluation/depreciation rates

[25] Results for a two-year consecutive event (*event case 2*) are not reported as they would involve a significant number of combinations.

being quite low immediately before and after the episode. This last feature is relevant as it suggests that the currency was stable around the episode, and thus eliminates any possibility of the exchange rate being driven by other persistent macroeconomic factors, including hyperinflationary episodes.

Output dynamics around the time of two consecutive currency collapses, ie *event case 2*, follows a similar, but less well defined, pattern (Figure 1, bottom-left panel). Prior to the currency collapse, output growth is low (less than 1%), picks up at the time of the first and second crash and then increases gradually. By contrast, the exchange rate dynamics shows a well-defined pattern (Figure 1, bottom-right panel): i) the first devaluation/depreciation (labelled T-1) is on average larger than the second one (labelled T); ii) following the currency collapse, the exchange rate change stays at a level that is on average lower than the one before the event took place; and finally, iii) on average, the magnitude of the first currency collapse in the *event case 2* is larger than that occurring when the currency collapse is a one-time episode, ie during the *event case 1* (60% vs. 55%, comparing the upper and lower right-hand panels).

Taking these events together, it can be concluded that, on average, there is a slowdown at least a year prior to the currency collapse, that growth is positive after the currency collapse, and that the impact on output differs depending on the persistence of the currency crash. on their own these results suggest that currency collapses on average and in the medium-term are not associated with contractionary effects on output. On the contrary, following such episodes, growth tends to pick up.

5. Econometric evidence: impact of currency collapses on output

In this section we aim at quantifying the behaviour of output around the time of a currency collapse. In contrast with previous sections, the econometric analysis that follows incorporates a control group (ie countries that do not experience currency collapses). This has two main advantages. First, it deals with possible *selection bias* problems, and second, it allows determining whether growth dynamics differ between countries that experience a currency collapse vis-à-vis those that do not. The estimation relies on two complementary econometric methodologies. The first is a static panel analysis, which follows Forbes (2002). However, we take the methodology a step forward and simulate the average behaviour of output trend following a currency crash. The second is a dynamic panel analysis, which complements the previous results in a more stylised manner. This approach, proposed by Cerra and Saxena (2008) following Romer and Romer (1989), has two main advantages. On the one hand, it allows evaluating, *ceteris paribus*, the permanent impact on output through impulse response functions to a currency shock. On the other hand, it explicitly controls for *endogeneity bias*.

5.1 A static econometric analysis

This sub-section examines the impact of currency collapses on output growth rates using two-way fixed effects panel regressions. The estimated benchmark equation is given by:

$$g_{i,t} = \sum_{j=-3}^{3} \beta_j D_{i,t-j} + \delta_1 Infla_{i,t} + \nu_i + \omega_t + \varepsilon_{i,t} \quad (1)$$

where $g_{i,t}$ is real GDP growth rate in country *i* in year *t;* $Infla_{i,t}$ is the inflation rate and $D_{i,t-j}$ is the dummy for currency collapses.[26] Specifically, $D_{i,t}$ is equal to one if country *i* had a currency collapse in period *t.* Finally, we include the unobserved effects, where ν_i is an idiosyncratic time-constant but cross-sectional varying component; ω_t is the time-varying but cross-section constant factor; and $\varepsilon_{i,t}$ is the error term. The motivation for regressing growth on leads and lags of the currency dummy variable is to retrieve information on what is happening before and after the currency crash.

Several results stand out using our three basic definitions to estimate equation 1 (Table 6). *First*, countries experiencing a currency collapse witness output growth rates that are on average between 1.3 and 1.8 percentage points lower the year prior to the episode than in those experiencing no currency collapse. *Second*, these countries also display on average lower growth rates in the year of the event. The estimated coefficients are statistically significant, and their magnitudes suggest an output growth rate that is on average between 1.4 and 2.6 percentage points below the ones that do not witness a collapse. *Third*, output growth rates in countries with currencies collapsing vis-à-vis those that do not, are not statistically different a year after the episode. *Fourth*, under definition 3, we find moderate and statistically significant positive effects on growth two and three years after the currency crash. *Finally*, inflation appears to be a statistically significant control (intuitively the sign is negative: higher inflation reduces real growth).

An aspect worth highlighting is that although our estimates suggest that growth experiences a slowdown on the year prior to and the year of the collapse, on average it remains positive. In other words, we do not find evidence in the sample suggesting that currency collapses are on average contractionary, neither prior nor after the episode takes place.

Two additional results emerge after controlling for the persistence of the currency collapse (*event cases 1* and *2* in Table 6). First, one-time currency collapses tend *to occur after a strong slowdown.* Indeed, in such cases growth rates are estimated to be about two percentage points below the control group in the two years prior to the currency collapse or two percentage points below the control group in the year of the collapse. Second, persistent collapses show no statistically significant effects around the currency crash. Thus, we can conclude that the *currency collapse-output relationship can vary with the persistence of the currency collapse*.

5.1.1 Simulation analysis

An alternative way of summarising the previous results is by using the econometric results to simulate the effects of currency collapses on output trend. To implement this, we construct an index for the level of output and plot the simulated dynamics (Figure 2).[27,28]

Before discussing the results it is worth noticing that several lines are plotted in Figure 2. The blue line is *trend output* (ie output trend in the absence of a collapse). The green line with the confidence band displays the actual output dynamics for countries that experienced a currency collapse. Finally, the orange and discontinuous line is the counterfactual output

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[26] Controlling for inflation is important for at least two reasons. First, to take into account the possible impact of price changes on output growth. Second, to secure that results are not driven by hyper-inflationary episodes.

[27] Thus at T-4 the level of output is set to 100 and the statistically significant estimated growth rates are applied to this index. In this manner, we are able to construct the output trend for an average economy that witnesses a currency crash, as well as for one that remains unaffected, to which we will also refer to as trend output.

[28] Results for event case 2 are not reported as all the coefficients are statistically insignificant.

path that would have prevailed in a country that entered into a currency collapse dynamics but in which the currency crash never materialised. These output paths allow us to decompose the medium-term effects (ie after three years) of currency collapses on output into three components (see Figure 3 and Table 7):

i) *Maximum output loss*. Depicted by the vertical distance between trend output (blue line in Figure 2) and the imaginary output level that would have prevailed in the countries that followed the path of a currency collapse, but in which the collapse never occurred (orange discontinuous line);

ii) *Output gain associated with a currency collapse.* Captured by the vertical distance between the actual output level that prevailed after the currency collapse (green line) and the imaginary output trend that would have prevailed in the absence of the collapse (orange discontinuous line);

iii) *The net output loss*. Captured by the difference of the two previous effects, ie the vertical distance between trend output (blue line), and the output path that prevailed in countries that followed a currency crash (green line).

Our estimates indicate that output costs three years after the collapse range from an average of 1.9% under definition 3 to 6.3% in the case of one-time currency collapses (Figure 2 and Table 7). However, such losses tend to materialise prior to the currency collapse. About three years before the collapse actual output (green line) begins to deviate from trend (blue line). Nonetheless, currency collapses are also found to play a corrective role as reflected by the upward change in output trend following the collapse (green line). As a matter of fact, in the absence of the currency collapse output losses would have been much larger than those observed. Such counterfactual view estimates the gains associated with the currency collapse to range from 4.9% to 7.7% depending on the definitions employed, or by 6.3% in the case of one-time currency collapses (Table 7).

Thus three conclusions can be derived from the simulations. First, in the medium-term currency collapses are associated with a net output loss.[29] Second, currency collapses play an important adjustment role. Finally, one-time currency collapses lead to the largest net losses, highlighting once again the importance of the persistence of these events.

Our results are similar in spirit to those reported by Hong and Tornell (2005), but our story is somewhat different. According to them, currency crises lead to permanent output losses because the average ex-post growth is below the ex-ante average growth rate. In other words, for them output losses materialise after the collapse and not prior to the crash as suggested by our results. We do not have a good explanation for these divergent results. However, we believe that our methodology has some advantages over theirs, including the fact that it is less arbitrary. Our results are based on a larger data set and deals with sample selection. Moreover our findings are consistent with those reported in the previous section, in particular with the claim that growth is positive after the currency collapse.

5.2 A dynamic panel analysis

So far we have examined the output dynamics around the time of a currency collapse without making causality statements about their relationship. To deal with endogeneity bias we follow Cerra and Saxena (2008). Specifically, we estimate a univariate forecasting autoregressive model in output growth rates using panel data with fixed effects and report the group averages of impulse responses of output to the shock. Such specification accounts for the

[29] One should of course be cautious when interpreting these counterfactual experiments as we are not identifying the underlying shocks.

non-stationarity of output and for serial correlation in growth rates, and allows to identify the impact of currency crashes on the level of output.[30] The model estimated is given by:

$$g_{i,t} = \alpha_i + \sum_{j=1}^{4} \gamma_j g_{i,t-j} + \sum_{s=1}^{4} \delta_s D_{i,t-s} + \varepsilon_{i,t} \quad (2)$$

This specification ensures that currency collapses only have a lagged effect on output.[31] The impulse response function of this forecasting equation provides an estimate of the total effect of a currency collapse over a time horizon.[32] It thus provide a natural way of summarising the output response to currency collapses, as it traces the effect of a unit shock to the currency collapse variable, D, including the feedback effect through lagged output. However, in doing so, it is unable to capture output costs incurred before the depreciation, thus in this sense, the exercise is *ceteris paribus*. Finally, the impulse response function (IRF) is reported relative to output trend, and, to facilitate the analysis, the impulse responses for the change in output are cumulated to ensure that they reflect movements in levels.

Our estimates suggest that currency collapses, *ceteris paribus*, have positive effects on output (Figure 4). We find positive long-run effects on output trend in the case of *definition 1* and *event cases 1 and 2 (but statistically insignificant in the other cases).* In the last two cases, the long-run impact is twice the effect identified using definition 1 (4.6% vs 2.2%). More importantly, such positive effects are felt after two years, and the maximum impact is fully materialised after five years. Notice that we emphasise *ceteris paribus* because, unlike earlier results, the dynamics described here does not consider any output losses prior to the collapse. It is for this reason that impulse response dynamics are closer in spirit to the counterfactual currency collapse gains identified in the previous section and of similar order of magnitude (Table 7).

Of course, the reason why, *ceteris paribus*, growth picks up after a currency collapse is an open question. The most natural explanation can be related to the fact that standard expansionary transmission channels "kick-in" following the collapse and dominate any contractionary effect (see Tovar (2005) and (2006)). For instance, that would be the case for the export competitiveness or the expenditure switching effects. Alternatively, explanations may simply reflect self-correcting mechanisms in the economy. That is, important imbalances in the economy may be corrected following a currency collapse, allowing growth to resume with better fundamentals ie a sort of "cleansing or balancing" effect. These arguments require further empirical analysis and are not examined here.

6. Robustness analysis: sample breakdowns

How robust are the patterns and results presented so far? In particular, i) how stable are they over time and regions?; and ii) what, if any, is the role of the exchange rate regime?

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[30] The degree of serial correlation is determined by F-test, which suggested estimating an AR(4). The estimated equation is also extended to include the current and lagged impacts of the shock.

[31] The results do not change in any significant manner, even when we include contemporaneous currency collapses in equation 2.

[32] A caveat of this exercise is that this methodology does not control for the length of the currency collapse nor by shock size. This also implies that we give each shock the same weight.

6.1 Time dimension

The pattern of output dynamics around the time of a currency collapse, which we identified in the previous section, can be quantitatively sensitive to the time sample chosen, nonetheless many qualitative results survive (see the static panel regressions -Tables 8 and 9 - or the IRFs derived from the dynamic panel analysis Figures 5-7).[33]

Specifically, we find that much of the results seem to be characteristic of the 1980s onwards. For instance, the slowdown of output a year prior to a currency collapse is mainly a characteristic of these decades. Contemporaneous adverse effects are less robust, but also tended to occur during these decades depending on the definition employed. We also find that output trend losses are smaller in the 1960s given the ex-post positive effects of currency collapses. IRFs also suggest that in the 1980s and 1990s there is an ex-post positive effect of currency collapses. However, for the rest of the sample, the IRFs are mostly statistically insignificant.

Of course a question that arises is how should we interpret the sensitivity of results to a time breakdown. A possibility is that the nature of shocks, including their size and persistence, has changed over time. The evidence reported provides some support for this, as reflected, for instance, by the increasing average size of *one-time currency collapses*. For example, during the 1990s and 2000s such collapses exceeded 60%, compared with an average of 40% during previous decades (Annex Figure 1, right-hand panels).

Another possibility is that shifts in the relationship over time may reflect changes in the underlying conditions of the economies being analysed ie the fundamentals of the economy have varied and therefore the type of vulnerabilities leading to the currency crash (or existing at the time of the crash) changed too. This would in turn imply that the relative importance of the transmission channels has shifted over the past four decades. Thus, for instance, changes in the degree of openness, degree of dollarisation, currency mismatches, financial integration, financial market development or exchange rate pass-through, all of which are known to have changed, may have altered the relative importance of these channels.

Finally, it is worth noticing that the sensitivity of results to period breakdowns contrasts with results reported by Gupta et al. (2007). These authors find a stable relationship between output dynamics and currency crises. Several factors may explain such divergent results. They identify currency crises on the basis of episodes identified by a number of different studies, to which they apply a majority rule. Although they claim that applying such rule windows out crises too close to each other, it appears that this might not be the case. They also treat all crisis episodes equally, independently of their persistence. Here, we have shown that one-time currency collapses induce output and exchange rate dynamics that can differ from those associated with consecutive ones. Thus, it appears that clustering the analysis of currency collapses to specific periods of time may be more reasonable, in particular if the economic events or financial weaknesses that lead to certain types of currency collapses are common during a specific period of time. In this regard, theory does suggest that driving factors leading to a currency collapse have changed over time. This is clearly reflected in the evolution followed by the theoretical literature eg first, second, and third generation models of currency crises, sovereign debt default models or models of sudden stops.

[33] The event case studies are reported in Annex Figures 1 and 2.

6.2 Regional dimension

Economic fundamentals may determine important differences in the patterns reported so far. Although it is beyond the scope of this paper to explore which underlying country-specific factors may shape these differences, it is possible to gain some insight on the role of economic fundamentals by exploring the robustness of our results across regions. The underlying assumption is that regional groupings capture to some extent common structural characteristics of the economies being analysed.

Our results show differences in *the size of currency collapses across regions*. On the one hand, one-time collapses have been much larger in Africa (on average around 60%) and smaller in Asia (on average about 40%) - possibly reflecting greater distortions or economic imbalances in Africa than in Asia (Annex Figure 3). On the other hand, the size of consecutive currency collapses varies considerably across regions. For example, the first collapse is smaller in magnitude in Africa and Asia than in Latin America or other countries, while the second collapse tends to be fairly similar across regions (Annex Figure 4).

Our econometric analysis confirms that results can be sensitive to regional breakdowns, although most of the qualitative findings tend to survive. For example, we find evidence of growth slowdowns or recessions prior to or at the time of a currency collapse in Latin America, Africa and, to a lesser extent, in Asia (Figure 8 and Tables 10 and 11). Results also suggest that in Latin America currency collapses tend to have an important adverse contemporaneous effect, which is corrected over the medium term except when the currency collapse is persistent (Figure 8).

6.3 Exchange rate regimes

In section 4 we argued that the frequency and magnitude of currency collapses could be related to the exchange rate regime in place. However, we showed that currency collapses were common across all exchange rate regimes, and that the threshold for defining a currency collapse was fairly stable across them. Nonetheless, event case analysis reveals that currencies lose most of their value when they involve a peg (eg pegs or “free falling” regimes) or managed floats. Also that less flexible regimes (pegs, crawling pegs and managed floats) display higher growth rates after a currency collapse (Annex Figures 5 and 6). However, this last pattern tends to be more robust for one-time currency collapses. Lastly, we also find that currency crises or hyper-inflationary economies (as captured by the “free falling” category) induce a severe output slowdown at the time of currency collapse. This is a phenomenon that is more severe if a second currency collapse occurs, ie a persistent currency crash.

The static panel regression analysis reveals that output dynamics around the time of a currency collapse is not clearly related to the exchange rate regime in place. This is important since it indicates that the exchange rate regime by itself is not the main driver of output growth after a currency collapse. Possibly, the interactions of the exchange rate regime and other factors may be what matters for growth dynamics around these episodes (eg the collapse of a peg in the presence of currency mismatches). Nonetheless, we are able to pull out some specific general results. For example, we find that under less flexible regimes currency collapses occur once the economies have slowed down (Table 12). Also we can establish that when the episode is a one-time event, output growth falls relative to the control group one or two years prior to the currency collapse independently of the exchange rate regime in place (although it becomes a recession under the free falling category, see Table 13 and Figure 11). Finally, we find that medium-term (after 3 years) growth gains when the currency collapse is persistent and the exchange rate regime is relatively rigid.

7. Conclusions

This paper presents new empirical evidence of how currency collapses affect output. The relevance of answering this question is twofold. First, there is a theoretical ambiguity around the relative importance of different transmission mechanisms. Since these mechanisms can operate in opposite directions, settling this question is an empirical exercise. Second, the existing empirical evidence has so far failed to provide conclusive evidence regarding the direction of this relationship.

The evidence reported relies on the largest data set assembled in the literature to study the currency collapse-output relationship. This has allowed us to reduce possible criticisms associated with small samples or selection bias. In addition, and in contrast to existing studies, we recognise that the persistence of these episodes may matter, and that currency collapses may affect not just output growth, but also its trend, an aspect that has been overlooked in the existing literature.

By using different and complementary methodologies, we find that currency collapses are associated with permanent output losses relative to trend, which are in the order of magnitude of 2 to 6% of GDP on average in the medium term (ie after 3 years). Moreover, we find that currency collapses tend to be preceded by a substantial slowdown in output. We also find that following the currency crash, growth tends to pick up, but still remains at a level below that which would have prevailed in the absence of a currency collapse. These two features suggest that output losses are not due to the currency collapse itself but rather due to the factors leading to it. On the contrary, we find that currency collapses induce, ceteris paribus, positive gains in output trend that fully materialise in a five-year horizon.

The evidence confirms that results can be sensitive to sample breakdowns, although many of the qualitative rather than the quantitative results appear to be quite robust. For example, we find that the impact of currency collapses has shifted over time in a non-uniform manner, which implies that relevant transmission channels have also changed. We also find that the effects of these episodes differ across regions, possibly suggesting that fundamentals, economic and financial development, and other institutional factors may be relevant. Finally, our results also indicate that the relationship is not clearly linked to the exchange rate regime in place at the time of the currency collapse.

Certainly, before drawing policy conclusions it is important to emphasise that these results are subject to a number of caveats. Our estimations are based on the evolution of output and the exchange rate, but ignore many factors that determine the welfare costs of currency collapses. Most importantly, the analysis does not address why the currency collapse occurs in the first place. As discussed in the literature review, there is a vast literature examining the factors and shocks behind currency collapses. Our analysis also has little to say about the mechanism involved after the currency collapse takes place. While we cannot disentangle the various factor involved, our results do suggest that expansionary mechanisms tend to dominate. That said, even if currency collapses can have a positive correcting effect on output, they can have undesirable side effects; for instance, inflation may increase or the financial system may become unstable.

From a policy perspective, our analysis raises several additional questions. For instance, why does output remain below trend for so long? And what can policies do to close the output gap faster? Unfortunately, we do not have a straightforward or general answer to these. With no doubt, future research should aim at answering such questions. Possibly, this will require bringing together two strands of the theoretical literature, which, we hope, may incorporate some of the key results we have presented. In particular, the one suggesting that the economic dynamics prior to the collapse matters, as well as the one showing that the persistence of the event is relevant.

Appendix

A. Data

The paper uses data from 1960-2006 from the World Development indicators - WDI - of the World Bank (growth rates) and the International Monetary Fund's-International Financial Statistics -IMF-IFS- (the *monthly* average nominal exchange rate and the monthly consumer price index - CPI).

B. List of countries

For comparability purposes, we employ the same sample of countries as in Gupta, Mishra and Sahay (2007).[34]

Africa (47 countries): Algeria, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Dem. Rep. of, Congo, Rep. of, Cote d'Ivoire, Djibouti, Equatorial Guinea, Ethiopia, Gabon, The Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Morocco, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa*, Sudan, Swaziland, Tanzania, Togo, Tunisia, Uganda, Zambia, and Zimbabwe.

Asia (21 countries): Bangladesh, Bhutan, China, Fiji, India, Indonesia, Korea, Rep., Lao PDR, Malaysia, Maldives, Myanmar, Nepal, Pakistan, Papua New Guinea, Philippines, Samoa, Solomon Islands, Sri Lanka, Taiwan POC, Thailand, and Vanuatu.

Latin America (26 countries): Argentina, Barbados, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, México, Nicaragua, Panama, Paraguay, Peru, St. Vincent and the Grenadines, Trinidad and Tobago, Uruguay, and Venezuela.

Other Countries (13 countries, including the transition economies and the Middle East): Czech Republic, Egypt, Hungary, Islamic Republic of Iran, Israel, Jordan, Lebanon, Malta, Oman, Romania, Syrian Arab Republic, Turkey, and Yemen.

[34] Yugoslavia was dropped due to lack of data.

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Table 1

Currency collapses: stylised facts

	Definition 1		Definition 2		Definition 3		Event case 1		Event case 2		
	No. of episodes	**Threshold value**	**No. of episodes**	**Threshold value**	**No. of episodes**	**Threshold value**	**No. of episodes**	**Threshold value**	**No. of episodes**	**Threshold value (1^{st} collapse)**	**Threshold value (2^{nd} collapse)**
Full sample	202	25.07	251	15.01	571	22.01	79	22.06	24	23.31	22.32
Decade											
1960s	17	27.45	26	15.27	39	22.06	6	22.06	3	23.31	23.95
1970s	23	25.31	33	18.45	62	23.12	12	23.12	6	23.40	30.16
1980s	72	25.50	78	15.34	214	22.52	24	23.04	3	29.69	42.32
1990s	75	25.07	78	15.10	205	22.01	32	22.29	6	23.67	22.32
2000s	15	26.14	36	15.01	51	22.02	5	26.14	6	23.81	24.75
Region											
Africa	88	25.36	123	15.01	233	22.02	40	22.06	7	23.81	24.75
Asia	30	25.50	43	15.20	53	22.25	21	22.91	5	23.67	23.95
Latin America	66	25.07	66	15.27	219	22.01	12	23.12	10	23.31	22.32
Other	18	25.31	19	15.20	66	22.29	6	22.29	2	25.31	38.84
Exchange rate regime											
Peg	42	25.07	76	15.27	73	22.06	33	22.06	9	23.31	22.32
Crawling	30	25.15	48	15.01	74	22.01	14	22.29	2	35.38	42.32
Managed float	40	25.21	51	15.13	101	22.52	15	22.91	3	23.67	23.00
Flexible	4	28.28	6	18.45	19	22.02	1	42.64	1	23.81	24.75
Freely falling	68	30.53	41	19.04	255	22.70	5	31.94	4	29.69	31.51
Unclassified	2	35.67	2	16.01	8	24.19	2	24.19	1	59.28	45.66

For definitions see Section 3 and appendix.

Table 1

Annual growth performance and currency collapses - Definition 3

Conditioning event at t=T			Output growth (g_t) dynamics following the conditioning event			
			Growth dynamics		Accelerating or decelerating growth	
			$g_{T+1} > 0$	$g_{T+1} > 0$ $g_{T+2} > 0$	$g_T < g_{T+1}$	$g_T < g_{T+1} < g_{T+2}$
Output expansion and currency collapse[2]	**Episodes**	398	335	296	187	68
	Conditional probability	0.70	0.84	0.74	0.47	0.17
	Median growth (%)	4.0	4.1 ; 4.6	4.1 - 4.7 - 4.7	3.2 ; 5.6	3.1 ; 4.6 ; 6.2
			$g_{T+1} < 0$	$g_{T+1} < 0$ $g_{T+2} < 0$	$g_T > g_{T+1}$	$g_T > g_{T+1} > g_{T+2}$
Output contraction and currency collapse[1]	**Episodes**	173	65	29	38	9
	Conditional probability	0.30	0.37	0.17	0.22	0.05
	Median growth (%)	-3.0	-3.6 ; -4.0	-3.8 ; -4.6 ; -3.9	-1.6 ; -5.1	-2.7 ; -4.4 ; -6.9
			$g_{T+1} > 0$	$g_{T+1} > 0$ $g_{T+2} > 0$	$0 < g_{T+1} < g_{T+2}$	
Output contraction and currency collapse[2]	**Episodes**	173	108	85	53	
	Conditional probability	0.30	0.62	0.49	0.30	
	Median growth (%)	-3.0	-2.8 ; 3.9	-2.6 ; 3.8 ; 5.1	-2.4 ; 2.9 ; 5.9	

1 Followed by economic contraction; 2. Followed by economic expansion

Currency collapse as captured by *definition 3*. See section 3. For the median growth rates the numbers correspond to the various years (T, T+1, etc).

Table 2

Likelihood of growth acceleration after a currency collapse - Definition 3

Conditioning event		Output growth (g_t) dynamics following the conditioning event		
		Accelerating output growth (g_t)		
		$0 < g_T$	$0 < g_T < g_{T+1}$	$0 < g_T < g_{T+1} < g_{T+2}$
Output expansion at T-1 and currency collapse at T	**Episodes (total 387)**	294	140	48
	Conditional probability	0.75	0.36	0.12
	Median growth (%)	4.1 ; 4.0	4.1 ; 3.4 ; 5.5	3.9 ; 3.2 ; 4.3 ; 5.8
Average output expansion between T-3 and T-1 and currency collapse at T	**Episodes (total 420)**	303	146	55
	Conditional probability	0.72	0.35	0.13
	Median growth (%)	3.7 ; 4.8	3.5 ; 3.2 ; 5.5	3.6 ; 3.1 ; 4.5 ; 6.1
		$0 < g_T$	$0 < g_T < g_{T+1}$	$0 < g_T < g_{T+1} < g_{T+2}$
Output contraction at T-1 and currency collapse at T	**Episodes (total 178)**	98	45	19
	Conditional probability	0.55	0.25	0.10
	Median growth (%)	-2.5 ; 3.8	-1.8 ; 1.8 ; 5.8	-1.3 ; 1.9 ; 4.8 ; 6.8
Average output contraction between T-3 and T-1 and currency collapse at T	**Episodes (total 128)**	75	31	11
	Conditional probability	0.58	0.26	0.08
	Median growth (%)	-1.8 ; 4.0	-2.2 ; 3.3 ; 5.9	-2.4 ; 1.5 ; 5.3 ; 6.9

Note: Currency collapse as captured by *definition 3*. See section 3. For the median growth rates the numbers correspond to the various years (T, T+1, etc).

Table 3

Annual growth performance and currency collapses - Event case 1

Conditioning event at T			Output growth (g_t) dynamics following the conditioning event			
			Growth dynamics		Accelerating or decelerating growth	
			$g_{T+1} > 0$	$g_{T+1} > 0$ $g_{T+2} > 0$	$g_T < g_{T+1}$	$g_T < g_{T+1} < g_{T+2}$
Output expansion and currency collapse	**Episodes**	58	51	44	35	14
	Conditional probability	0.73	0.88	0.76	0.60	0.24
	Median growth (%)	4.5	4.3 ; 6.0	4.2 – 6.0 – 5.8	3.2 ; 5.6	2.8 ; 5.4 ; 8.4
			$g_{T+1} < 0$	$g_{T+1} < 0$ $g_{T+2} < 0$	$g_T > g_{T+1}$	$g_T > g_{T+1} > g_{T+2}$
Output contraction and currency collapse	**Episodes**	21	3	2	3	1
	Conditional probability	0.27	0.14	0.10	0.14	0.00
	Median growth (%)	-2.5	-3.3 ; -4.0	-3.3 ; -4.1 ; -5.4	-3.3 ; -4.6	-3.3 ; -3.6 ; -5.4
			$g_{T+1} > 0$	$g_{T+1} > 0$ $g_{T+2} > 0$	$0 < g_{T+1} < g_{T+2}$	
Output contraction and currency collapse	**Episodes**	21	18	16	13	
	Conditional probability	0.27	0.86	0.76	0.61	
	Median growth (%)	-2.5	-2.0 ; 4.8	-2.0 ; 4.3 ; 5.5	-2.5 ; 3.8 ; 6.0	

Note: Currency collapse as captured by definition 3. See section 3. For the median growth rates the numbers correspond to the various years (T, T+1, etc).

Table 4

Growth acceleration after a one-time currency collapse - Event case 1

Conditioning event		Output growth (g_t) dynamics following the conditioning event		
		Accelerating output growth (g_t)		
		$0 < g_T$	$0 < g_T < g_{T+1}$	$0 < g_T < g_{T+1} < g_{T+2}$
Output expansion at T-1 and currency collapse at T	**Episodes (total 57)**	45	26	11
	Conditional probability	0.78	0.45	0.19
	Median growth (%)	3.9 ; 5.1	3.9 ; 3.9 ; 6.0	3.8 ; 3.8 ; 5.4 ; 9.1
Average output expansion between T-3 and T-1 and currency collapse at T	**Episodes (total 65)**	49	31	12
	Conditional probability	0.75	0.47	0.18
	Median growth (%)	4.3 ; 4.3	4.2 ; 3.2 ; 6.0	4.6 ; 3.5 ; 5.0 ; 7.5
		$0 < g_T$	$0 < g_T < g_{T+1}$	$0 < g_T < g_{T+1} < g_{T+2}$
Output contraction at T-1 and currency collapse at T	**Episodes (total 22)**	13	9	3
	Conditional probability	0.59	0.41	0.14
	Median growth (%)	-2.2 ; 1.3	-2.2 ; 0.9 ; 6.2	-0.8 ; 0.8 ; 5.3 ; 7.7
Average output contraction between T-3 and T-1 and currency collapse at T	**Episodes (total 13)**	8	4	2
	Conditional probability	0.61	0.31	0.15
	Median growth (%)	-3.4 ; 5.0	-1.2 ; 3.0 ; 7.2	-4.7 ; 0.9 ; 6.2 ; 11.7

Currency collapse as captured by Event Case 1. For the median growth rates the numbers correspond to the various years (T, T+1, etc).

Table 5

Output growth effects of currency collapses by definitions and event case

Dependent variable: output growth	Definition 1	Definition 2	Definition 3	Event case 1	Event case 2
Collapse $_{T+3}$	-0.36	-0.06	-0.43	-0.46	-0.98
	[0.42]	[0.40]	[0.34]	[0.73]	[1.06]
Collapse $_{T+2}$	-0.7	0.01	-0.39	-1.77**	-3.83
	[0.43]	[0.36]	[0.41]	[0.73]	[2.41]
Collapse $_{T+1}$ [a]	-1.82***	-1.51***	-1.27***	-2.44***	-2.75
	[0.55]	[0.49]	[0.35]	[0.63]	[1.79]
Collapse $_{T}$ [b]	-2.57***	-1.81***	-1.43***	-2.12**	-2.14
	[0.47]	[0.38]	[0.40]	[0.92]	[1.33]
Collapse $_{T-1}$	-0.28	-0.24	0.47	0.43	-1.16
	[0.37]	[0.41]	[0.31]	[0.59]	[1.07]
Collapse $_{T-2}$	-0.07	-0.17	0.54*	0.39	1.07
	[0.36]	[0.37]	[0.28]	[0.69]	[0.97]
Collapse $_{T-3}$	0.47	-0.04	0.72**	0.37	0.02
	[0.52]	[0.45]	[0.35]	[1.26]	[1.02]
Inflation	-0.00**	-0.00**	-0.00*	-0.00**	-0.00**
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Constant	5.59***	5.54***	5.55***	5.42***	5.46***
	[0.67]	[0.69]	[0.66]	[0.67]	[0.67]
Observations	3138	3138	3138	3138	3138
Countries	97	97	97	97	97

[a] For event case 2 this corresponds to the time of the first currency collapse. [b] For event case 2 this corresponds to the time of the second currency collapse.

Note: Two-way fixed effects. Robust standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. For definitions, see Section 3.

Table 6

Decomposition of the impact of currency collapses on output trend

(Three years after the collapse)

	Maximum potential loss had no currency collapse occurred at T	Gain associated with currency collapse	Net permanent net loss
Definition 1	-12.3	7.7	-4.3
Definition 2	-8.7	5.3	-3.2
Definition 3	-6.9	4.9	-1.9
Event Case 1	-12.9	6.3	-6.3

Note: Results based on two-way fixed effects panel estimates reported in Table 6. For definitions, see Section 3.

Table 7

Output growth effects of currency collapses by decade and definition 3

VARIABLES	1960s	1970s	1980s	1990s	2000s
Collapse $_{T+3}$	-0.75	-0.57	0.37	-0.39	0.62
	[0.97]	[1.16]	[0.56]	[0.61]	[1.49]
Collapse $_{T+2}$	2.38*	-0.72	-0.43	-0.04	-0.97
	[1.31]	[0.84]	[0.42]	[1.08]	[1.41]
Collapse $_{T+1}$ [a]	-0.38	-0.25	-0.99*	-1.37*	-1.66*
	[1.10]	[0.90]	[0.55]	[0.72]	[0.88]
Collapse $_{T}$ [b]	-0.59	-1.59	-1.34**	-1.14	-1.59**
	[1.37]	[1.03]	[0.58]	[0.80]	[0.70]
Collapse $_{T-1}$	1.47**	-0.28	0.37	0.85*	-0.37
	[0.66]	[1.19]	[0.58]	[0.46]	[0.79]
Collapse $_{T-2}$	1.37	2.10*	0.63	0.11	-1.29
	[1.45]	[1.08]	[0.49]	[0.46]	[0.84]
Collapse $_{T-3}$	1.11	-0.45	0.28	1.37	-0.15
	[0.92]	[0.79]	[0.55]	[0.84]	[0.56]
inflation	-0.00**	-0.02***	-0.00*	0.00	-0.01**
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Constant	4.56***	6.87***	3.69***	3.53***	4.71***
	[0.73]	[0.78]	[0.76]	[0.67]	[0.59]
Observations	339	652	830	938	379
Countries	57	69	93	96	95

Note: Two-way fixed effects. Robust standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. For definitions, see section 3. Grey areas indicate the period(s) in which currency collapses occurs.

Table 8

Output growth effects of currency collapses by decade and event cases

Dependent variable: output growth	Event case 1					Event case 2				
	1960s	1970s	1980s	1990s	2000s	1960s	1970s	1980s	1990s	2000s
Collapse $_{T+3}$	0.27	0.42	0.83	-1.54	2.23	8.01	-3.05	0.74	-1.1	2.69
	[1.04]	[2.94]	[1.42]	[1.22]	[4.88]	[5.26]	[2.51]	[1.47]	[1.43]	[2.52]
Collapse $_{T+2}$	2.32	-0.2	-1.68	-3.42*	0.07	3.82	-1.61	-0.71	-10.99	0.47
	[1.69]	[1.53]	[1.18]	[1.73]	[4.27]	[8.98]	[2.09]	[1.78]	[7.59]	[1.68]
Collapse $_{T+1}$ [a]	1.25	0.36	-3.00*	-3.24***	0.82	-0.27	-1.25	-4.82***	-1.84	-2.32
	[1.55]	[1.72]	[1.76]	[1.12]	[4.67]	[4.09]	[2.32]	[1.80]	[5.91]	[1.44]
Collapse $_{T}$ [b]	1.59	-2.17	-0.74	-2.71**	0.1	5.61*	-0.91	-10.19***	-2.31	0.51
	[2.80]	[2.63]	[2.32]	[1.31]	[5.98]	[3.28]	[0.98]	[1.24]	[3.99]	[1.41]
Collapse $_{T-1}$	3.16*	-2.09	1.33	0.24	3.76	3.36	0.59	-6.17***	-0.26	-0.95
	[1.72]	[1.93]	[1.66]	[0.85]	[3.34]	[4.65]	[1.71]	[2.20]	[3.06]	[0.60]
Collapse $_{T-2}$	15.08***	2.65*	-0.6	0.12	-1.43	6.5	1.02	-1.4	1.06	-1.84***
	[1.07]	[1.43]	[1.27]	[1.39]	[1.51]	[5.07]	[1.56]	[1.88]	[2.44]	[0.45]
Collapse $_{T-3}$	-0.44	-0.78	0.35	1.62	-1.4	-1.47	-1.98	2.49	-2.64**	-1.47
	[1.07]	[1.26]	[1.48]	[3.34]	[1.08]	[0.98]	[2.46]	[2.34]	[1.22]	[0.98]
Inflation	0.00	-0.02***	-0.00**	0.00	-0.01***	0.00	-0.02***	-0.00**	0.00	-0.01***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]
Constant	4.58***	6.78***	3.78***	3.53***	4.00***	7.12***	3.73***	3.33***	3.89***	7.12***
	[0.67]	[0.79]	[0.78]	[0.48]	[0.42]	[0.77]	[0.69]	[0.47]	[0.40]	[0.77]
Observations	339	652	830	938	379	652	830	938	379	652
Countries	57	69	93	96	95	57	69	93	96	95

[a] For event case 2 this corresponds to the time of the first currency collapse. [b] For event case 2 this corresponds to the time of the second currency collapse.

Note: Two-way fixed effects. Robust standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. For definitions, see section 3. Grey areas indicate the period(s) in which currency collapses occurs.

Table 9

Output growth effects of currency collapses by region and definition 3

Dependent variable: output growth	Africa	Asia	Latin America	Other
Collapse $_{T+3}$	-0.5	0.24	-0.24	-0.99
	[0.51]	[0.61]	[0.40]	[2.53]
Collapse $_{T+2}$	-0.8	0.57	0.11	-0.15
	[0.84]	[0.87]	[0.40]	[1.46]
Collapse $_{T+1}$ [a]	-1.33*	-1.02	-0.87**	-0.75
	[0.67]	[0.69]	[0.41]	[1.60]
Collapse $_{T}$ [b]	0.44	-2.47**	-3.26***	0.91
	[0.69]	[0.94]	[0.47]	[1.55]
Collapse $_{T-1}$	0.47	-0.8	0.41	-0.62
	[0.49]	[0.72]	[0.36]	[0.81]
Collapse $_{T-2}$	0.23	-1.02*	1.19**	-0.4
	[0.54]	[0.55]	[0.47]	[1.36]
Collapse $_{T-3}$	0.32	-0.07	0.67	4.65**
	[0.62]	[0.36]	[0.43]	[1.51]
inflation	0.00	-0.00*	-0.00***	-0.02*
	[0.00]	[0.00]	[0.00]	[0.01]
Constant	3.82***	6.50***	4.22***	6.18***
	[0.62]	[0.52]	[0.46]	[1.36]
Observations	1299	547	967	325
Countries	43	17	26	11

Note: Two-way fixed effects. Robust standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. For definitions, see section 3.

Table 10

Output growth effects of currency collapses by region and event cases

Dependent variable: output growth	Event case1				Event case 2			
	Africa	Asia	Latin America	Other	Africa	Asia	Latin America	Other
Collapse $_{T+3}$	0.61	0.48	-1.90**	2.08***	-4.36**	1.86	-0.62	4.21
	[1.47]	[0.55]	[0.87]	[0.51]	[2.05]	[1.36]	[1.10]	[2.41]
Collapse $_{T+2}$	-2.75*	0.24	-1.89	-0.5	-11.05	-3.31**	0.4	-1.84
	[1.52]	[0.64]	[1.25]	[2.89]	[7.80]	[1.55]	[1.18]	[2.67]
Collapse $_{T+1}$ [a]	-2.40**	-0.44	-2.75*	-2.42	2.59	-4.94***	-5.54***	-1.47
	[1.09]	[0.62]	[1.36]	[1.73]	[5.67]	[1.12]	[1.75]	[1.38]
Collapse $_{T}$ [b]	1.23	-2.24	-6.83**	1.22	1.9	-5.46	-3.80***	-0.57
	[1.04]	[1.63]	[2.47]	[3.71]	[2.43]	[4.02]	[1.11]	[1.08]
Collapse $_{T-1}$	0.9	0.42	-0.44	-0.93	0.82	-4.90***	-0.95	-3.51
	[0.94]	[0.69]	[1.12]	[3.61]	[1.72]	[1.52]	[1.87]	[2.29]
Collapse $_{T-2}$	-0.22	-0.1	1.12	-0.16	1.49	-0.85	2.50*	1.75
	[1.41]	[0.85]	[1.60]	[3.00]	[2.41]	[0.64]	[1.38]	[1.89]
Collapse $_{T-3}$	-0.56	0.06	0.14	5.71**	-0.03	-1.61*	1.99	-1.84
	[2.54]	[0.65]	[0.60]	[2.50]	[3.33]	[0.90]	[1.20]	[2.67]
inflation	0.00	-0.00**	-0.00***	-0.02	-0.00**	-0.00**	-0.00***	-0.02
	[0.00]	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]	[0.01]
Constant	5.49***	5.13***	5.25***	2.32	5.49***	3.83**	5.48***	2.35
	[1.79]	[1.67]	[0.79]	[4.37]	[1.78]	[1.44]	[0.70]	[4.35]
Observations	1299	547	967	325	1299	547	967	325
Countries	43	17	26	11	43	17	26	11

[a] For event case 2 this corresponds to the time of the first currency collapse. [b] For event case 2 this corresponds to the time of the second currency collapse.

Note: Two-way fixed effects. Robust standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. For definitions see section 3.

Table 11

Output growth effects of currency collapses by exchange rate regimes and definition 3

Dependent variable: output growth	Peg	Crawling peg	Managed float	Freely floating	Free falling	Unclassified
Collapse $_{T+3}$	-1.05*	0.35	-0.17	-0.47	-2.10**	-1.05
	[0.58]	[0.57]	[0.56]	[0.71]	[0.88]	[0.87]
Collapse $_{T+2}$	-1.04	-0.5	-0.15	-1.42	-0.39	-1.31
	[1.10]	[1.48]	[0.88]	[2.42]	[1.39]	[2.60]
Collapse $_{T+1}$ [a]	-2.64***	-1.68**	-0.69	-0.05	-0.69	-1
	[0.68]	[0.68]	[0.53]	[0.84]	[0.76]	[1.30]
Collapse $_{T}$ [b]	0.35	-0.01	-0.49	-0.93	-0.36	1.97
	[1.05]	[0.71]	[0.76]	[1.77]	[0.89]	[1.80]
Collapse $_{T-1}$	-0.02	1.34*	-0.03	0.67	0.44	0.67
	[0.57]	[0.74]	[0.56]	[2.00]	[0.91]	[1.47]
Collapse $_{T-2}$	0.58	0.52	0.46	0.49	0.95	0.77
	[0.68]	[0.60]	[0.54]	[0.99]	[0.70]	[1.44]
Collapse $_{T-3}$	0.49	-0.25	0.22	-2.72	0.26	-3.32
	[0.91]	[0.76]	[0.63]	[1.98]	[1.14]	[2.40]
Inflation	0.00	-0.02***	-0.01**	-0.02***	0.00	-0.01***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Constant	6.16***	6.82***	5.64***	5.45*	0.54	4.02**
	[1.01]	[1.63]	[1.30]	[2.90]	[2.58]	[1.51]
Observations	1447	963	879	336	585	333
Countries	82	67	67	28	54	29

Note: Two-way fixed effects. Robust standard errors in brackets. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. For definitions, see section 3. Grey areas indicate the period(s) in which currency collapses occurs.

Table 12

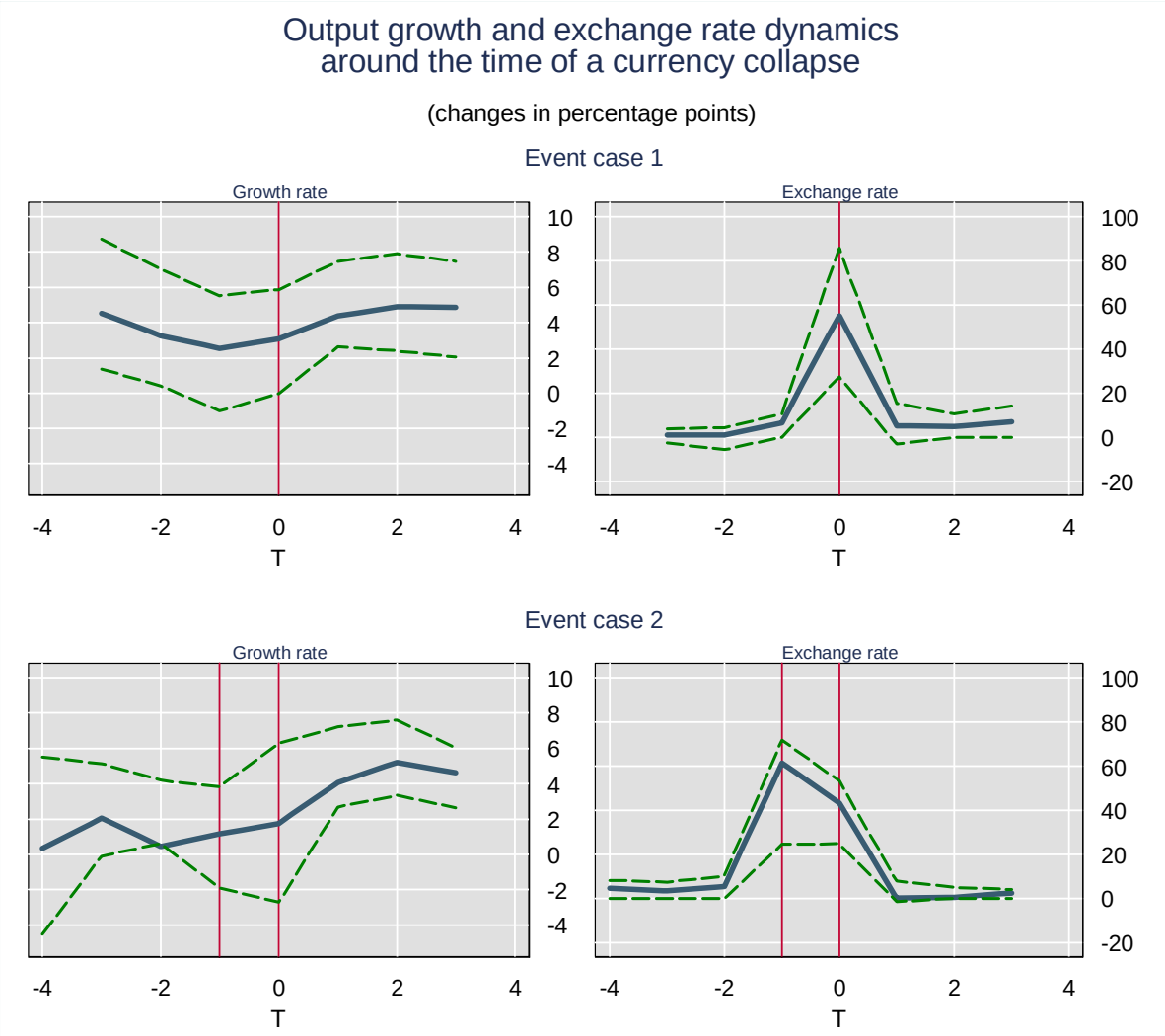
Output growth effects of currency collapses by exchange rate regimes and event cases

Dependent variable: output growth	Event case 1						Event case 2					
	Peg	Crawling peg	Managed float	Freely floating	Free falling	Unclass-ified	Peg	Crawling peg	Managed float	Freely floating	Free falling	Unclass-ified
Collapse $_{T+3}$	-0.93	-0.51	-1.24	-2.46	-1.95	-2.64	-2.08	-4.49	-0.25	-6.4	-10.79***	-8.17**
	[1.28]	[1.03]	[0.99]	[1.53]	[1.41]	[1.76]	[1.63]	[2.90]	[3.16]	[4.70]	[2.42]	[3.33]
Collapse $_{T+2}$	-1.74**	-3.94**	-0.94	-3.29***	-2.78**	-2.64**	-7.82	-14.01	-5.91	-24.9	-27.02	-31.38**
	[0.76]	[1.80]	[1.26]	[1.13]	[1.16]	[1.13]	[5.72]	[9.51]	[6.66]	[17.48]	[18.76]	[14.81]
Collapse $_{T+1}$ [a]	-2.93***	-2.00**	-2.60***	-2.74	-2.86	-2.39	-0.6	1.66	1.47	13.59	9.21	27.73***
	[1.02]	[0.94]	[0.94]	[2.23]	[2.15]	[2.39]	[3.65]	[7.45]	[4.88]	[10.79]	[6.99]	[5.78]
Collapse $_{T}$ [b]	0.06	-2.33*	-2.24	-8.25*	-2.12	-3.43	0.19	3.02	0.74	3.36	1.26	9.79***
	[1.15]	[1.37]	[1.79]	[4.74]	[2.51]	[3.00]	[1.20]	[2.37]	[4.16]	[4.18]	[3.67]	[3.34]
Collapse $_{T-1}$	0.78	-0.01	-0.96	0.88	-1.07	-0.18	-0.4	1.73	3.53*	3.48	3.12	9.20***
	[1.03]	[1.12]	[1.08]	[2.89]	[2.79]	[3.41]	[1.52]	[3.32]	[2.09]	[3.93]	[3.63]	[2.87]
Collapse $_{T-2}$	0.85	0.47	-0.52	-0.11	-0.21	-0.95	2.94***	3.83***	2.02	1.28	0.73	4.44**
	[1.24]	[2.00]	[1.54]	[3.84]	[3.41]	[3.75]	[1.01]	[1.14]	[1.58]	[2.68]	[3.01]	[1.98]
Collapse $_{T-3}$	-0.41	-2.7	-1.06	-6.89	-9.58	-9.85	0.53	2.68*	0.59	-0.05	-2.89	-0.01
	[2.36]	[3.66]	[3.10]	[7.22]	[7.73]	[8.14]	[1.56]	[1.49]	[1.02]	[1.72]	[2.11]	[2.48]
Inflation	0.00	-0.02***	-0.01**	-0.02***	0.00	-0.02***	0.00	-0.02***	-0.01**	-0.02***	-0.00*	-0.02***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Constant	3.05**	6.75***	5.49***	5.62**	-0.51	4.85***	6.26***	4.89***	5.54***	5.73*	0.21	7.15***
	[1.35]	[1.66]	[1.33]	[2.68]	[2.93]	[1.44]	[1.00]	[1.35]	[1.36]	[2.92]	[3.35]	[1.60]
Observations	1447	963	879	336	585	333	1447	963	879	336	585	333
Countries	82	67	67	28	54	29	82	67	67	28	54	29

[a] For event case 2 this corresponds to the time of the first currency collapse. [b] For event case 2 this corresponds to the time of the second currency collapse.

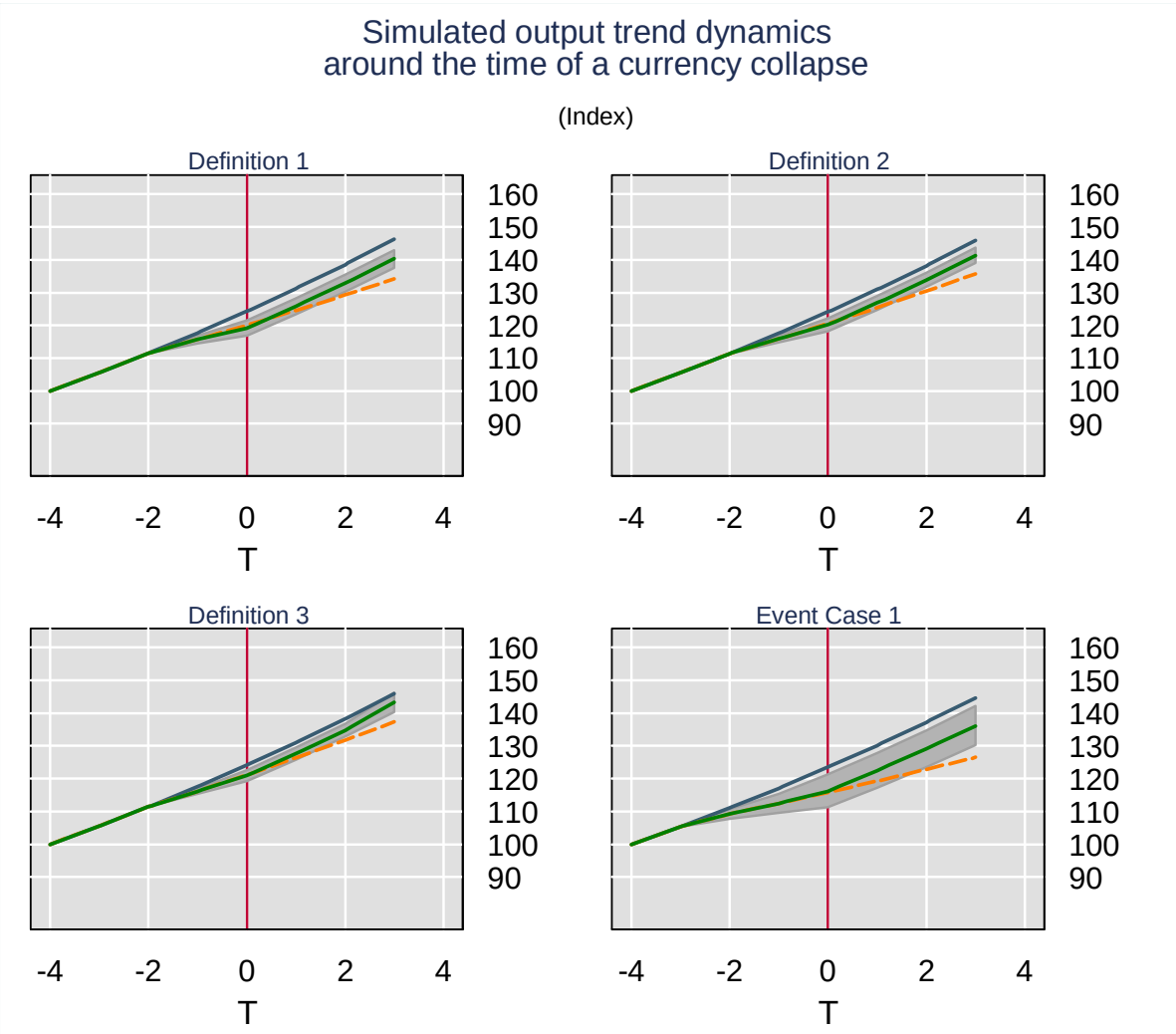
Note: same footnote as in Table 13 applies.

Figure 1



Event Case 1= currency collapse at time T and no collapse around a three-year window.
Event case 2= currency collapse at period T and T-1 and no collapse around a three-year window.
Note: The continuous line represents the sample average,while the dashed line represent the 25th and 75th percentiles.

Figure 2



Blue line: Output trend for the control group ie. no currency collapse.
Green line: Output trend for countries that experience a currency collapse at T.
Shaded area: 95% confidence interval.
Orange line: Output trend that would have prevailed had there been no currency collapse at T.
Note: All results based on two-way fixed effects panel estimates reported in Table 7 and 8.

Figure 3

Breakdown of simulated effects on output trend

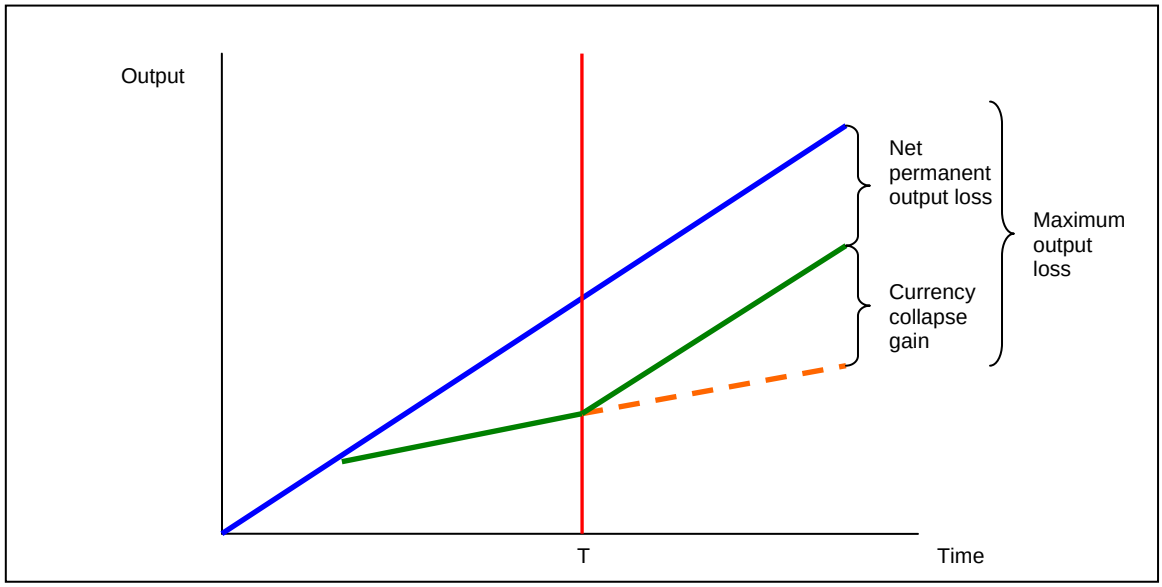
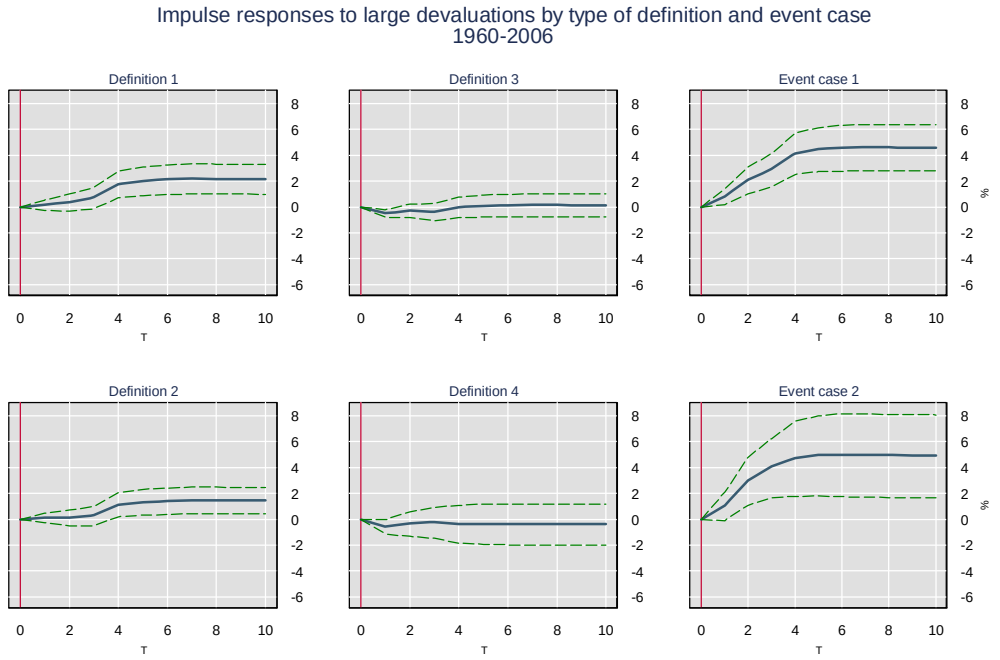
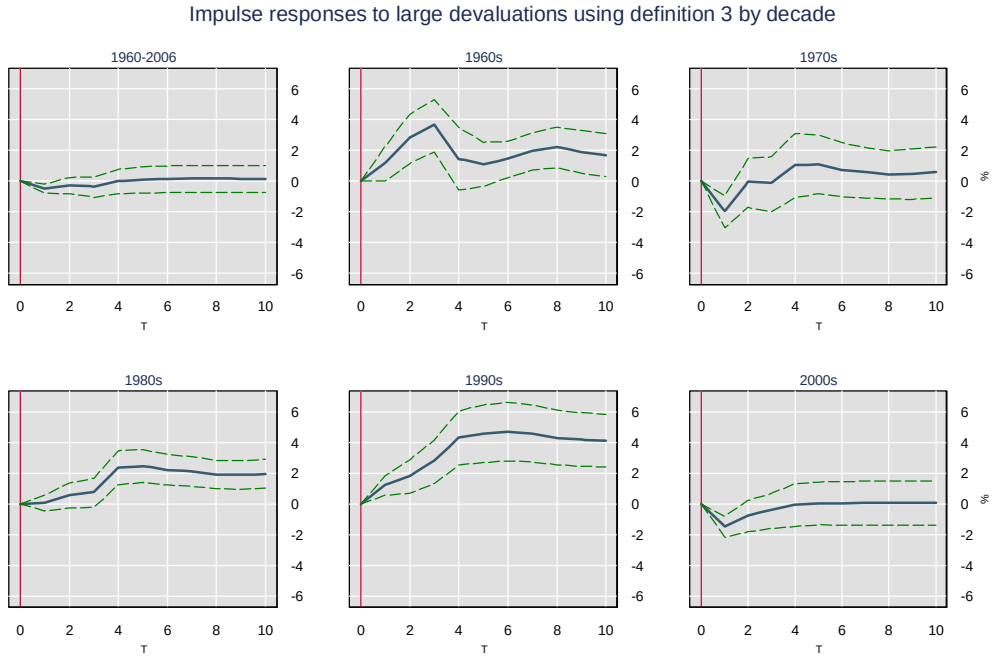


Figure 4



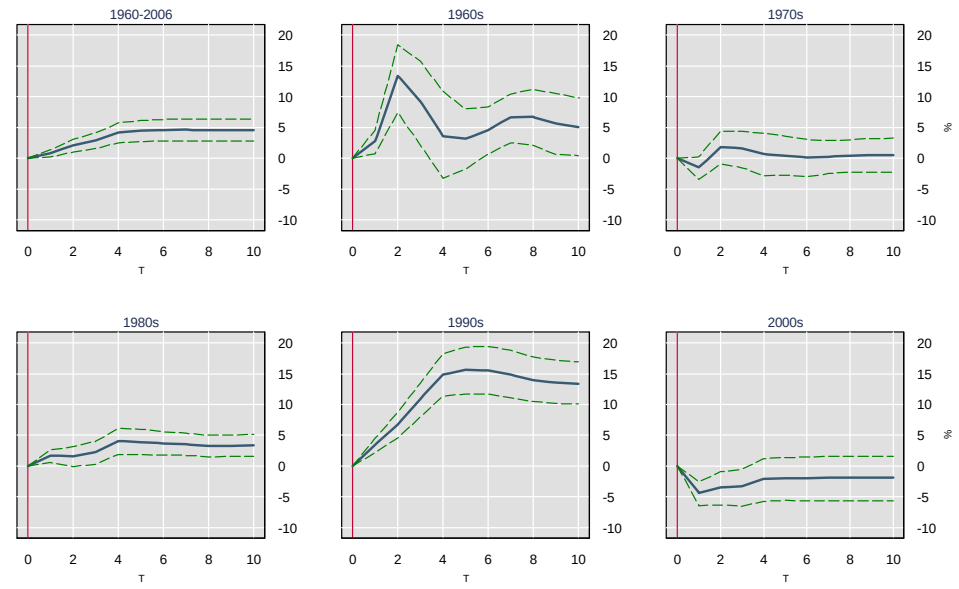
Note: The blue line represents the difference between the shock and the baseline, while the dotted lines represent that difference plus/minus one standard deviation.
Source: Authors' calculations based on IMF and national data.

Figure 5



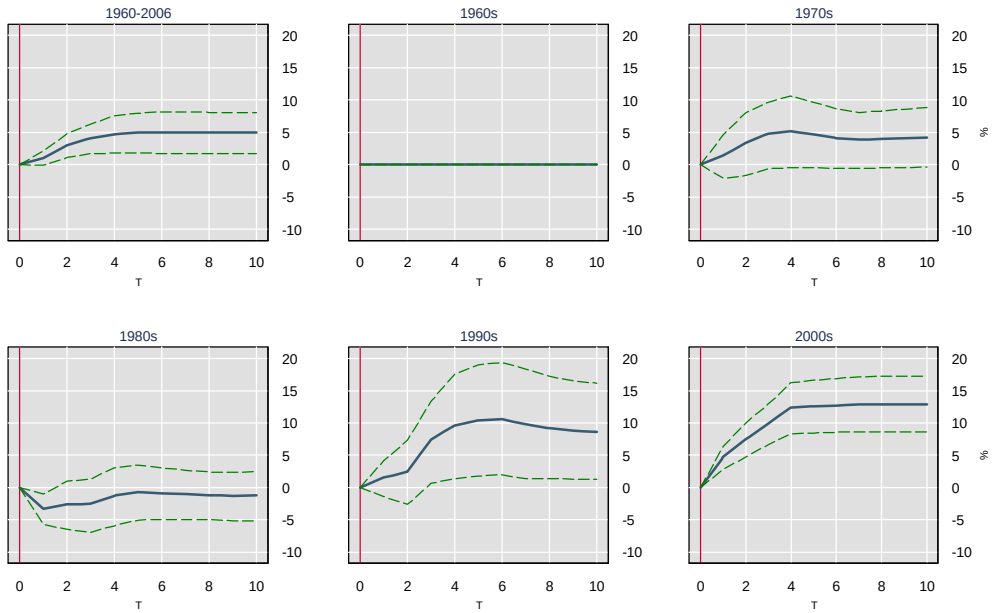
Note: The blue line represents the difference between the shock and the baseline, while the dotted lines represent that difference plus/minus one standard deviation.
Source: Authors' calculations based on IMF and national data.

Figure 6



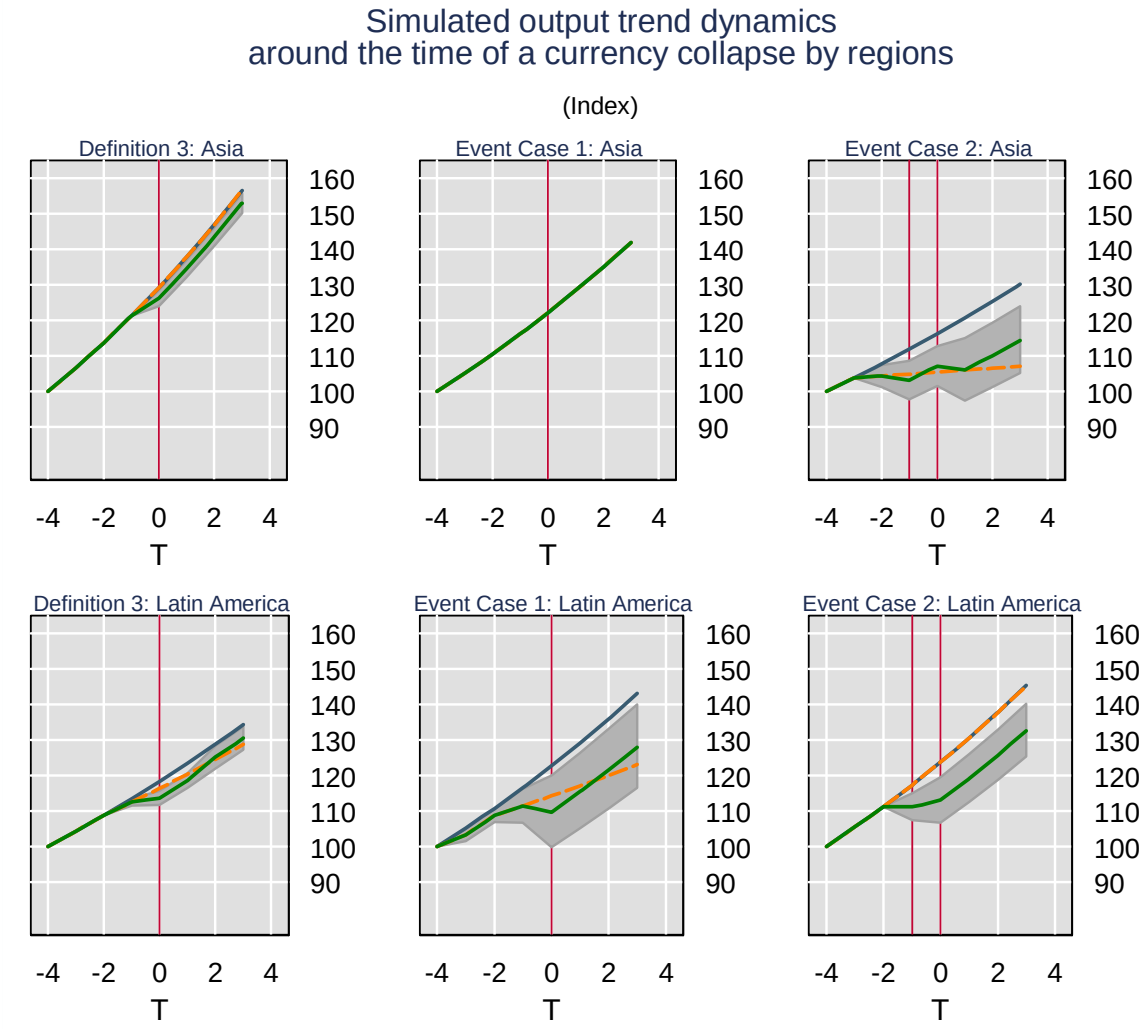
Note: The blue line represents the difference between the shock and the baseline,while the dotted lines represent that difference plus/minus one standard deviation.
Source: Authors' calculations based on IMF and national data.

Figure 7



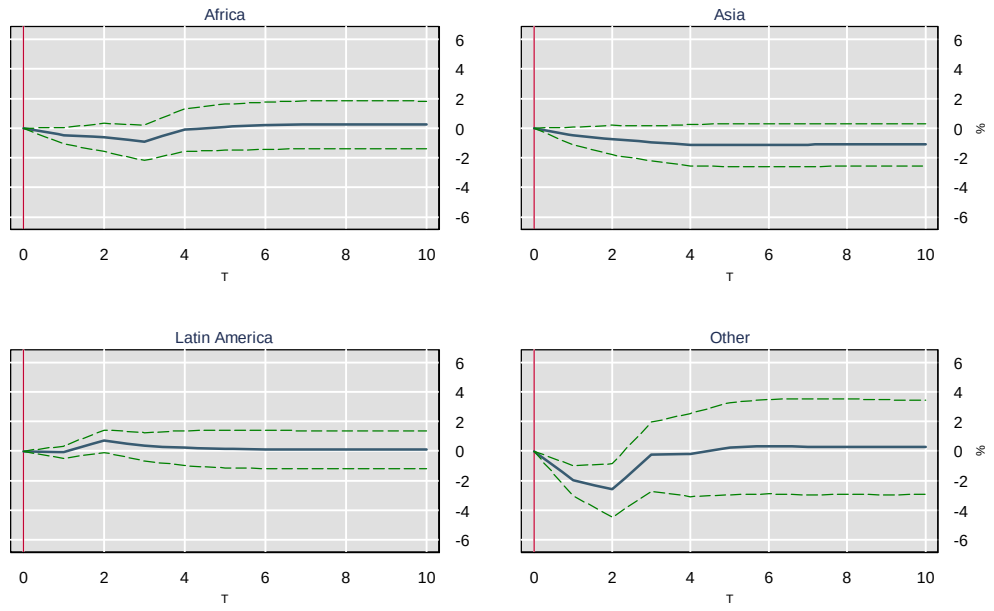
Note: The blue line represents the difference between the shock and the baseline,while the dotted lines represent that difference plus/minus one standard deviation.
Source: Authors' calculations based on IMF and national data.

Figure 8



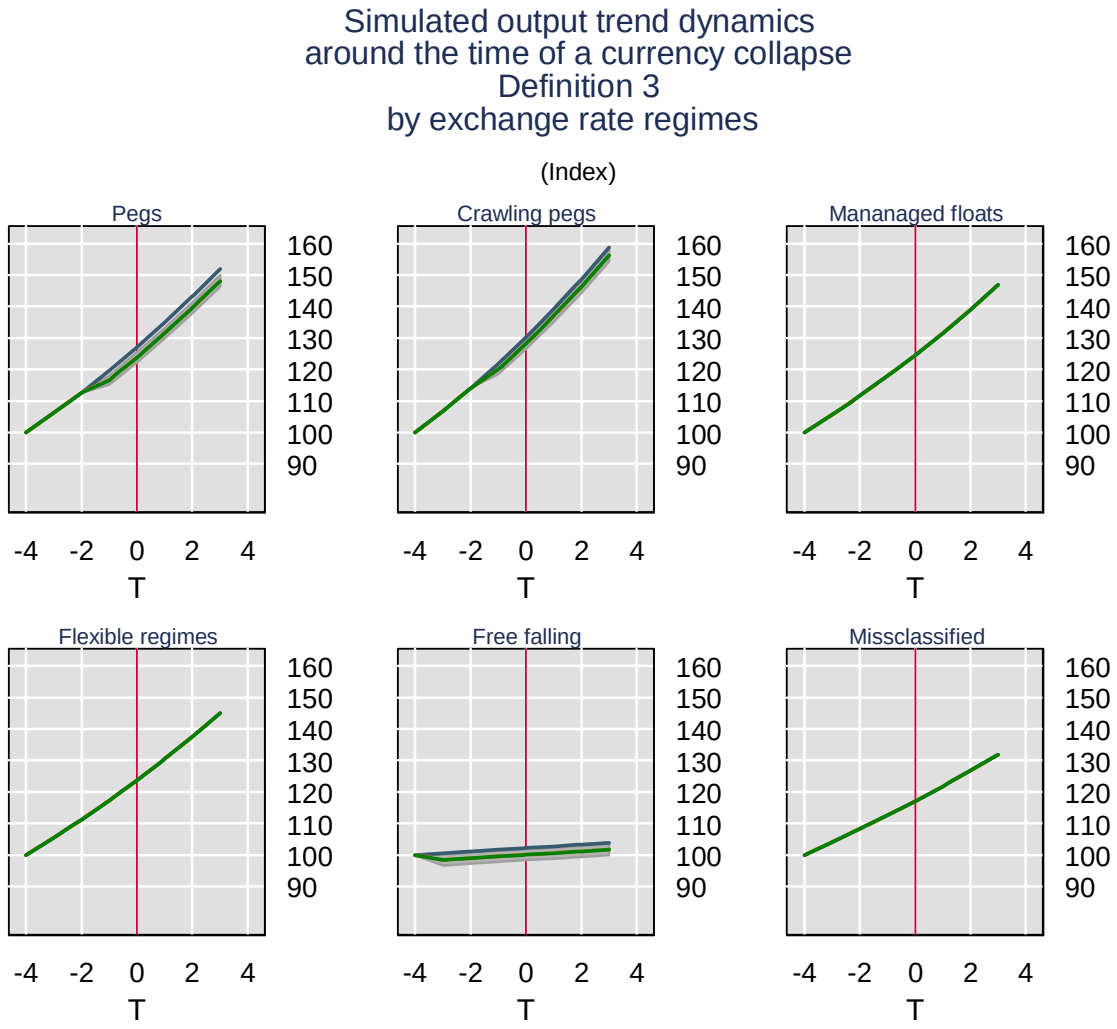
Blue line: Output trend for the control group ie. no currency collapse.
Green line: Output trend for countries that experience a currency collapse at T.
Shaded area: 95% confidence interval.
Orange line: Output trend that would have prevailed had there been no currency collapse at T.
Note: All results based on two-way fixed effects panel estimates reported in Table 7 and 8.

Figure 9



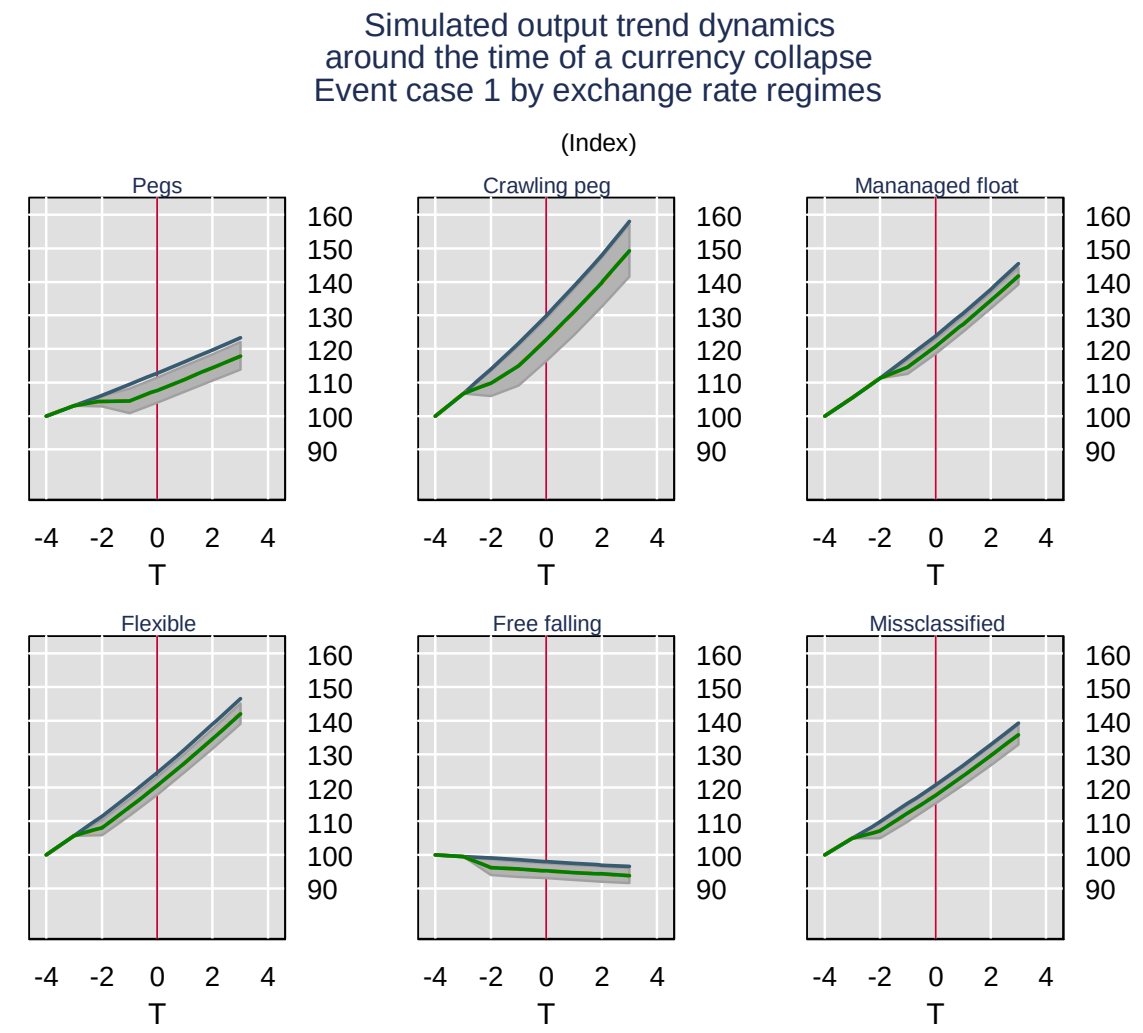
Note: The blue line represents the difference between the shock and the baseline, while the dotted lines represent that difference plus/minus one standard deviation.
Source: Authors' calculations based on IMF and national data.

Figure 10



Blue line: Output trend for the control group ie. no currency collapse.
Green line: Output trend for countries that experience a currency collapse at T.
Shaded area: 95% confidence interval.
Orange line: Output trend that would have prevailed had there been no currency collapse at T.
Note: All results based on two-way fixed effects panel estimates reported in Table 7 and 8.

Figure 11



Blue line: Output trend for the control group ie. No currency collapse.
Green line: Output trend for countries that experience a currency collapse at T.
Shaded area: 95% confidence interval.
Orange line: Output trend that would have prevailed had there been no currency collapse at T.
Note: All results based on two-way fixed effects panel estimates reported in Table 7 and 8.

Annex

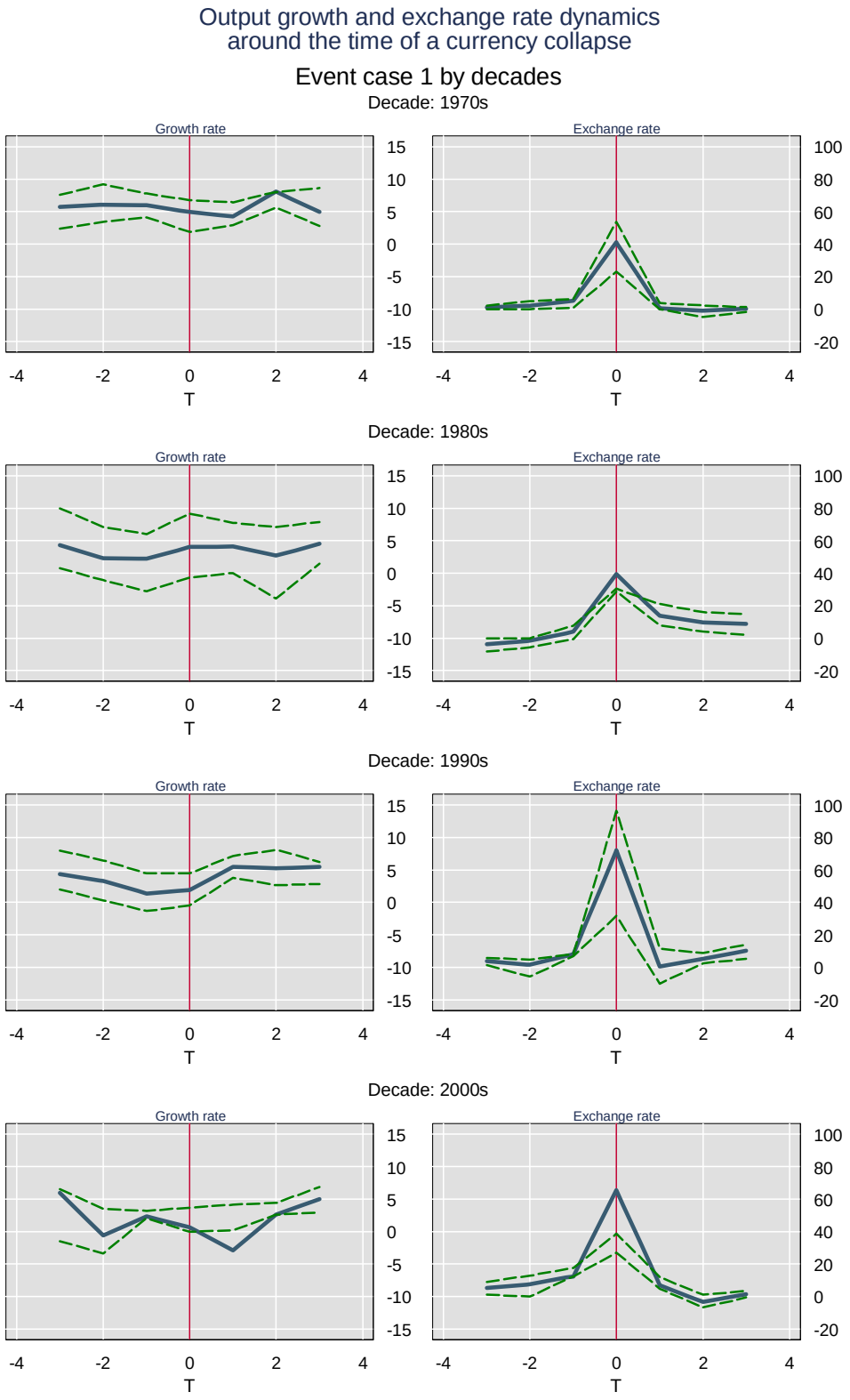
Annex Table 1

Growth acceleration after a persistent currency collapse

(Event case 2)

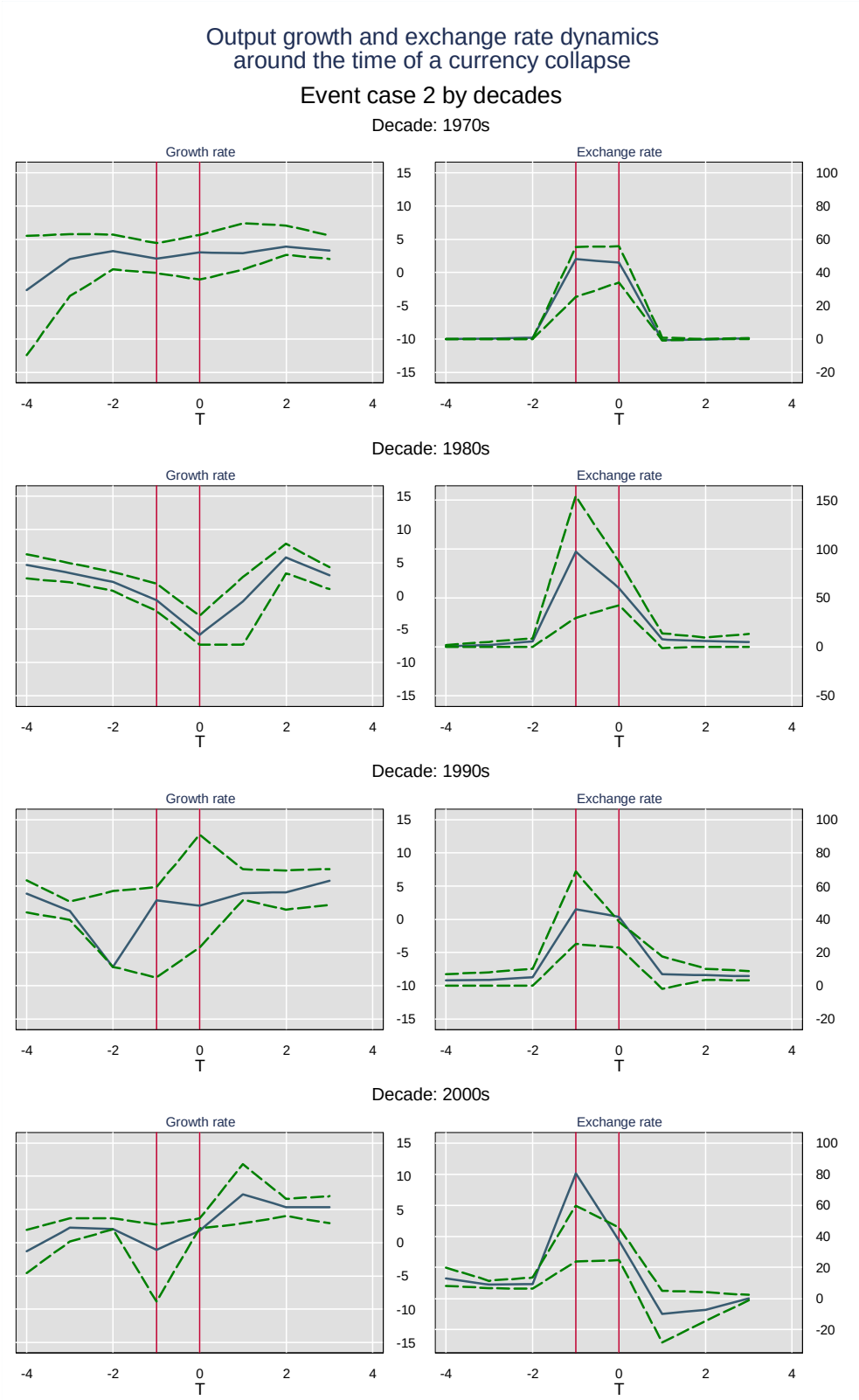
Conditioning event		**Output growth (g_t) dynamics following the conditioning event**		
		Accelerating output growth		
		$0 < g_T$	$0 < g_T < g_{T+1}$	$0 < g_T < g_{T+1} < g_{T+2}$
Output expansion at T-1 and currency collapse at T and T+1	**Episodes (total 20)**	16	5	1
	Conditional probability	0.80	0.25	0.05
	Median growth (%)	3.9 ; 4.1	1.6 ; 3.6 ; 7.5	4.4 ; 3.4 ; 9.0 ; 9.7
Average output expansion between T-3 and T-1 and currency collapse at T and T+1	**Episodes (total 27)**	17	5	2
	Conditional probability	0.63	0.18	0.07
	Median growth (%)	2.9 ; 4.6	2.4 ; 3.4 ; 7.5	6.7 ; 2.7 ; 9.1; 10.2
		$0 < g_T$	$0 < g_T < g_{T+1}$	$0 < g_T < g_{T+1} < g_{T+2}$
Output contraction at T-1 and currency collapse at T and T+1	**Episodes (total 15)**	6	2	1
	Conditional probability	0.40	0.13	0.06
	Median growth (%)	-3.0 ; 6.7	-6.4 ; 2.0 ; 10.6	-1.9 ; 2.0 ; 9.3 ; 10.7
Average output contraction between T-3 and T-1 and currency collapse at T and T+1	**Episodes (total 8)**	5	2	0
	Conditional probability	0.62	0.25	0
	Median growth (%)	-4.4 ; 5.3	-7.1 ; 3.8 ; 13.7	-
Currency collapse as captured by Event Case 2. See section 3.				

Annex Figure 1



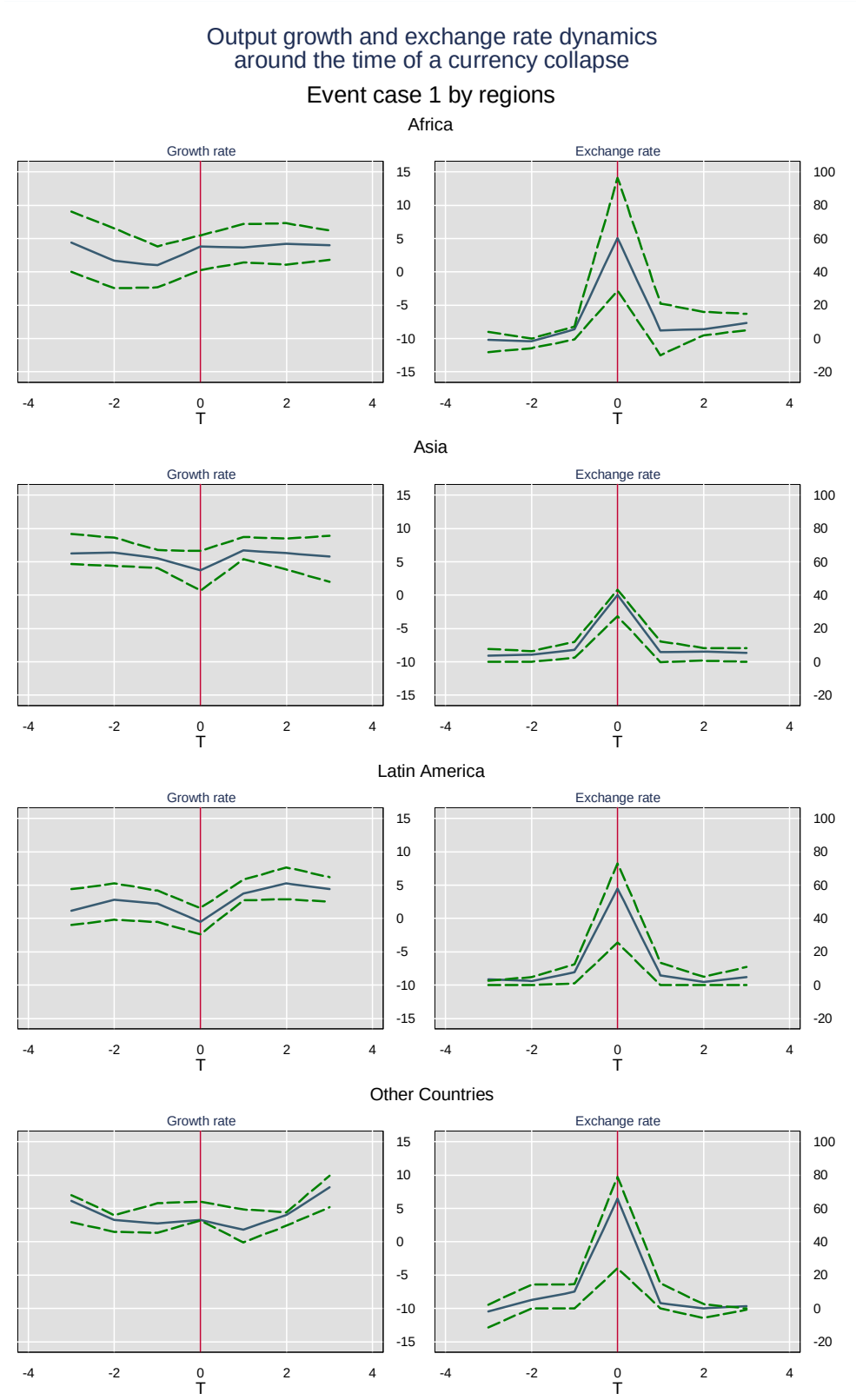
Event Case 1= currency collapse at time T and no collapse around a three-year window.
Note: The continuous line represents the sample average,while the dashed line represent the 25th and 75th percentiles.

Annex Figure 2



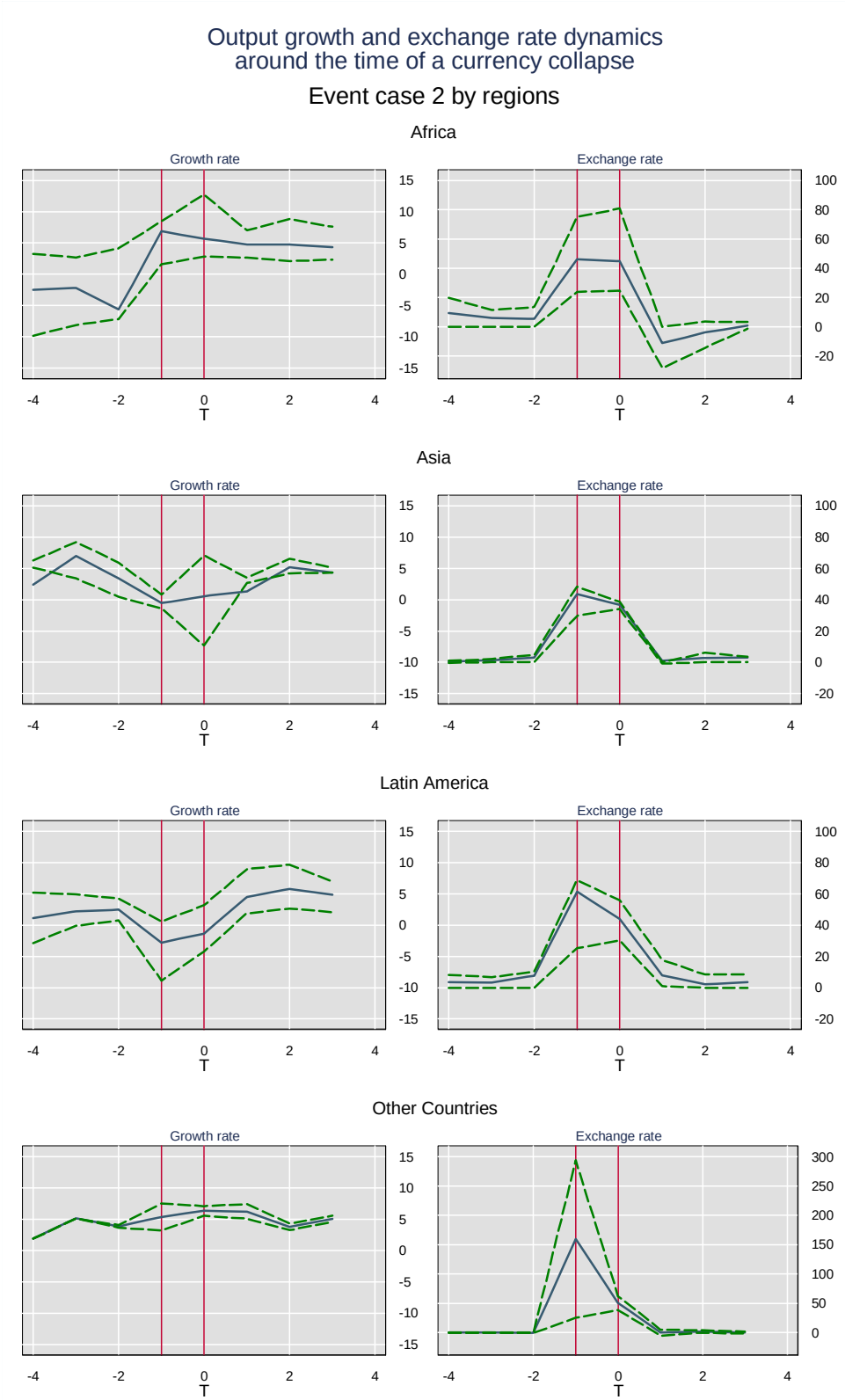
Event case 2= currency collapse at period T and T-1 and no collapse around a three-year window.
Note: The continuous line represents the sample average,while the dashed line represent
the 25th and 75th percentiles.

Annex Figure 3



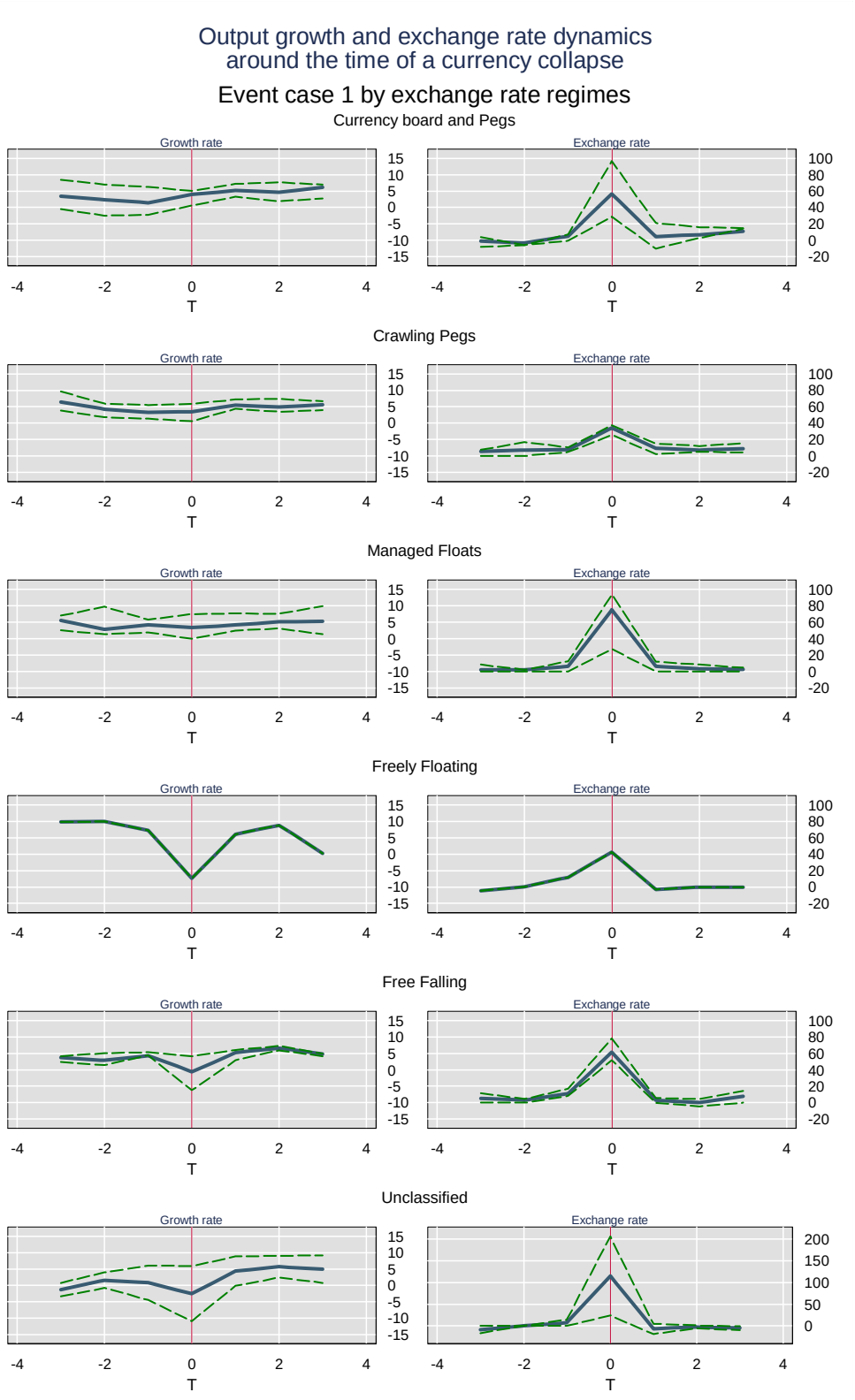
Event case 1= currency collapse at period T and no collapse around a three-year window.
Note: The continuous line represents the sample average,while the dashed line represent the 25th and 75th percentiles.

Annex Figure 4



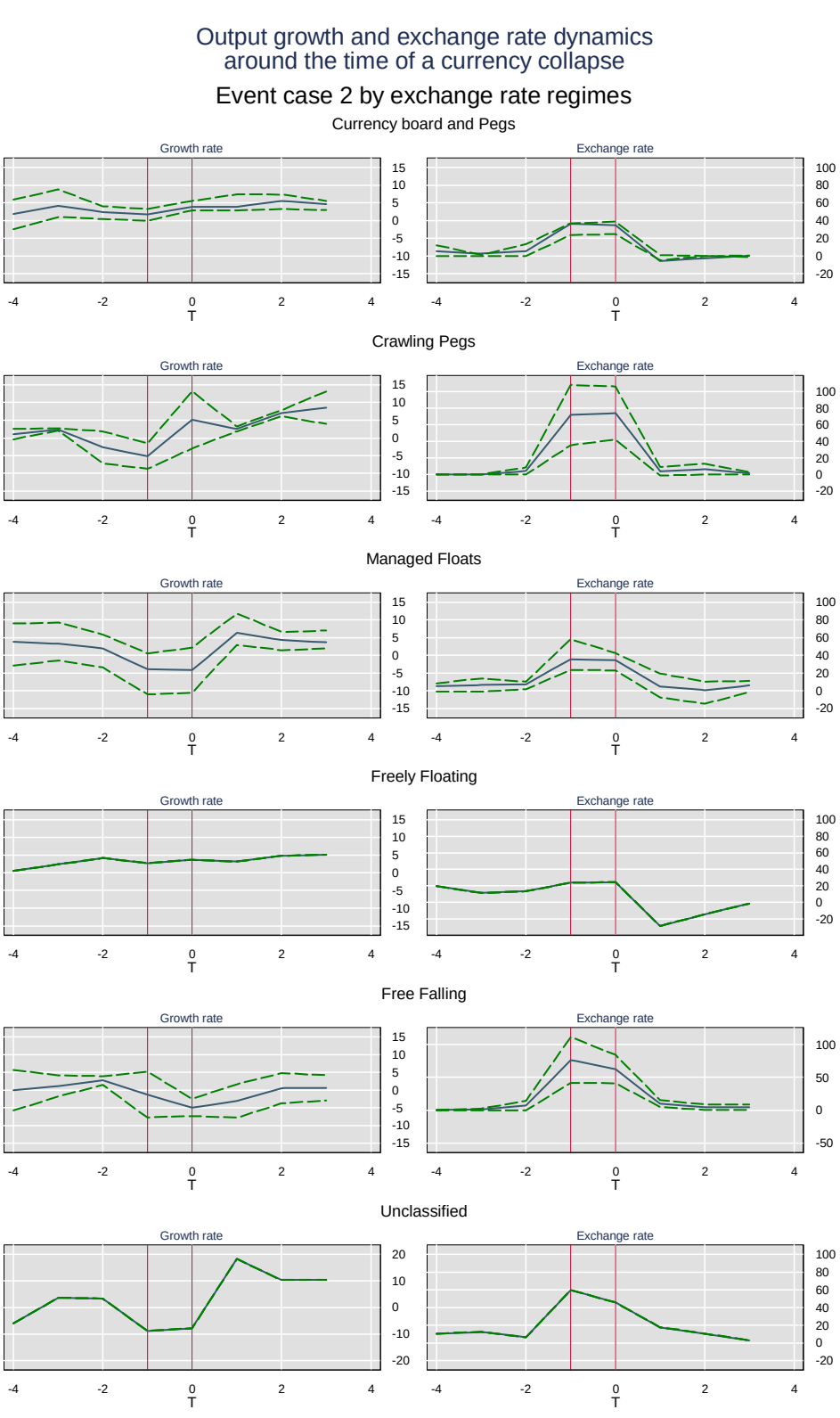
Event case 2= currency collapse at period T and T-1 and no collapse around a three-year window.
Note: The continuous line represents the sample average,while the dashed line represent
the 25th and 75th percentiles.

Annex Figure 5



Event Case 1= currency collapse at time T and no collapse around a three-year window.
Note: The continuous line represents the sample average,while the dashed line represent the 25th and 75th percentiles.

Annex Figure 6



Event case 2= currency collapse at period T and T-1 and no collapse around a three-year window.
Note: The continuous line represents the sample average,while the dashed line represent the 25th and 75th percentiles.