To Defend or Not to Defend? That is the Question

Barry Eichengreen and Andrew Rose
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Barry Eichengreen
Department of Economics
University of California
Berkeley, CA 94720-3880
Tel: +1 (510) 642-2772
Fax: +1 (510) 643-0926
eichengr@econ.berkeley.edu

Andrew K. Rose
Haas School of Business
University of California
Berkeley, CA 94720-1990
Tel: +1 (510) 642-6609
Fax: +1 (510) 642-4700
arose@haas.berkeley.edu

* Eichengreen is George C. Pardee and Helen N. Pardee Professor of Economics and Political Science at the University of California at Berkeley, Research Associate at the National Bureau of Economic Research, and Research Fellow at the Centre for Economic Policy Research. Rose is B.T. Rocca Jr. Professor of Economic Analysis and Policy in the Haas School of Business at the University of California, Berkeley, Research Associate at the NBER, and Research Fellow at the CEPR. We thank Carlos Arteta and Galina Hale for research assistance, the National Science Foundation, the Ford Foundation and the World Society Foundation for financial support, and Cam Harvey, Aart Kraay, David Leblang and Gian Maria Milesi-Ferretti for help with data. The analysis was begun while Rose visited the Reserve Bank of New Zealand and Victoria University in Wellington; he thanks those institutions for hospitality and support. The STATA data set used to generate the results is available at http://haas.berkeley.edu/~arose.

I. Introduction

This paper adds an observation to the stock of empirical regularities in the literature on financial instability. Comparing the behavior of failed and successful defenses of currency pegs (equivalently, successful and unsuccessful speculative attacks), we show that the costs of unsuccessfully defending against an attack are large. They are equivalent to approximately one year of economic growth: three percentage points of GNP in the year immediately following a crisis and roughly half that amount in the succeeding year. But the exceptional output losses that follow failed defenses are only evident for short periods; the difference between successful and unsuccessful attacks is significant for just a year.

This finding helps to account for a number of observations about the behavior of open economies and their policy makers.

- **Readiness to mount a defense.** We regularly observe governments and central banks attempting difficult policy adjustments (sharp hikes in interest rates, large fiscal cuts) in order to defend their currencies, despite objections that these policies may precipitate recession. Our finding explains this behavior: the output costs of the alternative -- failure to defend the currency -- are even higher in the short run.[1]
- **IMF exchange rate advice and conditionality.** While the IMF has repeatedly urged its members to abandon soft pegs in favor of greater exchange rate flexibility, it has also extended generous financial assistance to countries seeking to defend their currencies

[1]Which is of course the horizon relevant to governments which depend on popular support for their political survival.

against attack.[2] Again, our finding helps to explain this behavior: exiting a peg in a crisis tends to result in costly output losses, something which the IMF as well as national authorities wish to avoid.[3]

- **The V-shaped recovery from the Asian crisis.** A number of observers have commented on the "V shaped" recovery of Asian economies from their 1997-8 crisis (sharp falls in output were followed by equally sharp recoveries after an interval of one to two years). Rather than reflecting unique characteristics of Asia's crisis or its economies, as sometimes suggested, we show that this pattern is in fact quite general.[4] It is the prototypical response of output to a successful attack.[5]

The question is whether this post-crisis behavior of output is a *consequence* of the unsuccessful defense of the currency or simply a reflection of the *causes* of that failure. Is it the

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[2]In the words of the Managing Director, "Experience has shown that heavily managed or pegged exchange rate regimes can be tested suddenly by exchange markets, and that it can be very costly either to defend them or to exit under disorderly circumstances. On balance, we have a responsibility to advise our members that while such regimes can succeed, the requirements for a country to maintain a pegged or heavily managed exchange rate are daunting — especially when the country is strongly engaged with international capital markets" (Koehler 2001, pp.3-4).

[3]A point previously documented in Appendix A of Eichengreen and Masson et al. (1998).

[4]Thus, authors like Sachs and Stiglitz have pointed to the quick rebound of output in countries like Korea as evidence that their crises reflected problems of investor panic rather than flawed fundamentals like those which underly currency crises in many other emerging markets. Insofar as our results suggest that there was nothing special about the nature of the post-crisis behavior of output, such inferences become more difficult to draw.

[5]One might similarly cite the speed with which Italy and the United Kingdom recovered from the ERM crisis. Observers of that crisis were struck by the speed with which Italy and the United Kingdom recovered from the shock of being ejected from the Exchange Rate Mechanism of the European Monetary System in 1992 (Gordon 1999). Again, our results suggest that there is little if anything atypical about this episode.

resolve to mount a successful defense that determines the subsequent behavior of output? Or is it the behavior of output (and associated variables) that determines the success or failure of the defense?[6]

Clearly, the benefit of the doubt should be given to the view that it is differences in the pre-crisis characteristics of economies that explain both differences in their abilities to rebuff a speculative attack and differences in the post-attack behavior of output. Imagine, for example, that growth is weakening and unemployment is rising; in other words, a recession looms. The authorities will then be less ready to resort to higher interest rates to defend the currency. Knowing this, speculators will have more incentive to attack and a greater likelihood of success (Jeanne 1997). Because output movements are persistent, post-crisis macroeconomic performance will be disappointing. But it is not the success or failure of the defense that determines the behavior of output; rather, it is the behavior of output that determines the success or failure of the defense. To put the point another way, it is a third variable (the pre-crisis state of the economy) that determines the response both of policy makers and of the economy to the crisis.[7]

Given this presumption, it is striking that we are unable to detect differences in the pre-

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[6]In other words, is it the decision of how to respond to the speculative attack that shapes the subsequent performance of the economy, or do countries that are unable to defend their currencies have other problems that both render them unable to beat back the speculators and contribute to the severity of their post-crisis recessions?

[7]It is possible to imagine a variety of other plausible arguments working in the same direction. For example, a heavy load of short-term foreign-currency-denominated debt could both make governments less willing to raise interest rates to defend the currency (since higher interest rates will raise debt-servicing costs) and make thepost-crisis economic performance weaker (since devaluation will make life more difficult for firms whose debts are denominated in foreign currency but whose revenues are domestic-currency denominated).

crisis state of the economy that can explain the very different performance of countries that mount successful and failed defenses.

- There are no significant differences in the behavior of output prior to successful and unsuccessful attacks.
- There are no significant differences in the behavior of other economic and financial variables prior to successful and unsuccessful attacks.
- There are no significant differences in the behavior of political variables prior to successful and unsuccessful attacks.
- Econometric techniques designed to account for unobservable differences in countries mounting successful and unsuccessful defenses do not weaken the finding of significant differences in the subsequent behavior of output.
- The addition of country credit ratings as a way of capturing otherwise unquantifiable economic and financial vulnerabilities changes none of our findings.
- Our key results survive a long list of additional sensitivity analyses.

While the facts are clear, their interpretation is less so. Our preferred interpretation — conjectural, to be sure — is as follows. Failure to successfully defend a currency against attack is a shock to confidence. Involuntary abandonment of a exchange-rate regime which previously served as the nominal anchor for policy raises doubts in the minds of the markets about the prospects for stability. We thus observe a loss of policy discipline following a failed defense: the growth of the money base accelerates, and inflation increases. Risk premia rise, depressing consumption and investment. Only countries which succeed in establishing a clear and credible

alternative monetary anchor — Brazil's resort to inflation targeting following involuntary abandonment of its exchange rate peg in early 1998 springs to mind as an example — succeed in avoiding these costs.

We establish these points in a paper organized as follows. Section II describes the data and their characteristics. Sections III then subjects them to multivariate analysis. Section IV reports the results of a series of sensitivity analyses. Section V, in concluding, returns to the broader implications of our findings.

II. Data

The macroeconomic and financial data used in this paper were extracted from the 2000 *World Development Indicators* (WDI) CD-ROM, produced by the World Bank.[8] They are annual and cover the period 1960-1998. We consider essentially all middle- and high-income countries with an average population greater than one million (89 in number, of which 57 experience at least one crisis during the sample period).[9]

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[8]The macroeconomic and financial variables we utilize include real GDP, private consumption, the consolidated government budget deficit (as a percent of GDP), the official bilateral dollar exchange rate, gross international reserves, the ratio of reserves to imports, the current account balance (as a percent of GDP), exports and imports of goods and services, total debt service (as a percent of GNP), deposit and lending rates (in per cent), the interest rate spread (defined as the lending rate minus LIBOR), the CPI inflation rate, M1 and M2, credit to the private sector (as a percent of GDP), banking sector credit to the private sector (as a percent of GDP, and the market capitalization of listed companies (as a percent of GDP). The data set was checked and corrected for outliers and transcription errors. In addition, we use series on capital controls from the IMF's annual report on *Exchange Arrangements and Exchange Restrictions*, and country credit ratings from *Institutional Investor*, and political variables kindly provided by David Leblang.

[9]The exact list of countries is (in order of World Bank country code): Albania; United Arab Emirates; Argentina; Australia; Austria; Belgium; Bulgaria; Bolivia; Brazil; Brunei; Botswana; Canada; Switzerland; Colombia; Costa Rica; Cuba; Cyprus; Czech Republic; Germany; Denmark; Dominican Republic; Ecuador; Egypt Arab Rep.; Spain; Finland; France; Gabon; United Kingdom;

Our country sample is chosen to align closely with that used in Kraay (1998), enabling us to use that author's crisis dates.[10] Kraay defines a successful attack as the first observation following a year of stable exchange rates when the rate of currency depreciation exceeds 10 per cent.[11] Failed attacks are defined as episodes when non-gold reserves decline by at least 20 per cent after a year in which neither a successful nor a failed attack occurred.[12]

Greece; Guatemala; Hong Kong China; Hungary; Indonesia; Ireland; Iran Islamic Rep.; Iraq; Israel; Italy; Jamaica; Jordan; Japan; Korea Rep.; Kuwait; Lebanon; Libya; Morocco; Mexico; Macedonia FYR; Mauritius; Malaysia; Namibia; Netherlands; Norway; New Zealand; Oman; Peru; Philippines; Papua New Guinea; Poland; Korea Dem. Rep.; Portugal; Paraguay; Singapore; Slovak Republic; Sweden; Syrian Arab Republic; Thailand; Trinidad and Tobago; Tunisia; Turkey; Uruguay; United States; Venezuela; Yugoslavia FR (Serbia/Montenegro); and South Africa. Kraay does not actually list his countries, but we have followed his description as closely as possible.

[10]Among other things, this frees us of the objection that we have selected successful and unsuccessful attacks as a function of the subsequent behavior of output (especially since the purpose of Kraay's paper -- to analyze the efficacy of the interest rate defense -- is completely independent of our research).

[11]Kraay writes: "I first identify all episodes in which the one-month depreciation rate (i.e. the increase in the nominal exchange rate) exceeds 10%, which is roughly two standard deviations above the mean depreciation rate for the entire sample. In order for these large depreciations to be meaningfully considered successful speculative attacks, it is necessary that the exchange rate be relatively fixed prior to the depreciation itself. Accordingly, for each observation I construct the average over the previous twelve months of the absolute value of percentage changes in the nominal exchange rate. I then eliminate all large depreciation episodes for which this average exceeded 2.5%, or about one half of one standard deviation from the mean for the entire sample. I define these events as successful speculative attacks. Finally, in order to avoid "double-counting" prolonged crises in which the nominal exchange rate depreciates sharply for several months, I further eliminate successful attacks that were preceded by successful attacks in any of the prior twelve months."

[12]Again, to quote Kraay: "To identify unsuccessful speculative attacks, I first consider all episodes in which the monthly decline in non-gold reserves exceeds 20%, which is about two standard deviations above the mean decline in reserves for the entire sample. In order to restrict attention to large reserve losses incurred defending relatively fixed exchange rates, I eliminate all those episodes for which the same moving average of absolute values of changes in the nominal exchange rate as before was greater than 2.5%. Next, to eliminate large reserve losses accompanying successful attacks, I exclude all episodes in which the change in the nominal exchange rate in the same month or any of the three following months was greater than 10%. I define these episodes as failed speculative attacks and, as before, I eliminate all failed attacks

We begin with simple comparisons of economic and financial variables before and after attacks. In each case the average behavior of the variable in question is compared to the average behavior of the same variable for non-crisis periods -- that is, tranquil periods in which neither successful nor unsuccessful attacks occur -- and surrounded by a two-standard-deviation band.

Figures 1 and 2 portray the variables of interest from three years prior to three years after the event. Figure 1 considers domestic variables, Figure 2 external variables, for our 92 successful attacks and 184 failed attacks. Adding an exclusion window to ensure that we do not double count crisis observations does not noticeably change the results.

Consider first the top-left-hand panels of Figure 1, which display the development of GNP growth around the time of successful and unsuccessful attacks. They show that growth rate averages about 3 per cent in the three years preceding both successful and failed attacks. This is quite close to the average in non-crisis periods (as denoted by the horizontal line). Growth then falls sharply, to barely zero, in the year of a successful attack and the year following, before recovering to pre-attack levels. In contrast, there is little change in growth rates either before or after unsuccessful attacks.

We can reject at the 99 per cent confidence level that the post-crisis behavior of output is the same in countries that mount successful and unsuccessful defenses. Here, then, the first key result of this paper makes its appearance.

The other panels hint at what may be driving these differences in macro performance. M1 growth and inflation rise in the wake of unsuccessful defenses (but not in the wake of successful ones), suggesting a loss of monetary discipline when defense of the currency is

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that are preceded by a failed attack in any of the twelve previous months."

abandoned.[13] The rates of growth of consumption and investment fall, despite the decline in real interest rates that accompanies the acceleration in inflation, further suggesting a loss in confidence.[14] Interest-rate spreads (defined as the lending rate minus LIBOR) rise following unsuccessful defenses, again suggesting declining confidence and rising risk perceptions.

However, there are no comparable differences in the behavior of any of these variables in the three years preceding the event. Growth is no different in the run-up to successful and unsuccessful attacks. Inflation and money growth are no different. Budget deficits are no different. It is not obvious, in other words, that differences in the pre-crisis development of these macroeconomic variables explain the different outcome of the speculative attack.[15]

Figure 2 provides analogous evidence for external variables. Countries that experience a crisis display somewhat more real exchange rate appreciation, larger current account deficits and higher ratios of debt service to GNP (compared to countries that are not) prior to the event. This is plausible and consistent with mainstream models of the determinants of speculative attacks.[16] However, our concern is not whether there are differences between countries that do and do not experience crises (this being the subject of the large literature on leading indicators), but whether

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[13]The difference in M1 growth between successful and unsuccessful defenders just misses statistical significance at the 95 per cent confidence level. The difference in inflation does not approach significance at conventional confidence levels.

[14]The difference in post-crisis real interest rates between successful and unsuccessful defenders is statistically significant at the 95 per cent confidence level, but the difference in post-crisis consumption growth is not. (The same is true of investment.)

[15] Formal statistical tests show that none of these variables behaves significantly differently at anything approaching standard (95 per cent) confidence levels in the year preceding the event.

[16]For completeness, we note that the differences between the crisis and non-crisis countries are statistically significant at conventional confidence levels for the current account but not for the other two variables.

there are differences in the pre-crisis behavior of these variables between countries that mount successful and unsuccessful defenses. While there is some sign that countries that mount unsuccessful defenses tend to have more short-term debt in their total debt loan and to have experienced more real effective exchange rate appreciation in the run-up to the crisis (compared to the successful defenders), in no case is the behavior of these variables significantly different than in tranquil periods (as indicated by the two standard deviation bands), and in no case is the behavior of these variables significantly different in successful and unsuccessful defenders in the year preceding their crises.[17] There are no differences between successful and unsuccessful defenders in the size of the current account deficit in the year immediately preceding the crisis, and no discernible differences in the consequent debt service burdens.[18] We cannot reject (at anything approaching conventional confidence levels) the null that these external variables behave the same in the successful and unsuccessful defenders in the year preceding their crisis.

Following the crisis, the real effective exchange rate depreciates in countries which abandon defense of their currencies, relative to both the no-crisis cases and the successful defenders. Export growth accelerates and current accounts strengthen, consistent with the aforementioned collapse of consumption. These patterns are consistent with the very different post-crisis behavior of GNP growth in countries that mount successful and unsuccessful defenses against speculative attacks.[19]

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[17]Formally, we are unable to reject the null that their values are the same in successful and unsuccessful defenders at the 95 per cent confidence level.

[18]The statement in the preceding footnote again applies.

[19]However, the evolution of none of these three variables differs significantly (that is, at the 95 per cent confidence level) in the post-crisis period between successful and unsuccessful defenders.

Table 1 provides statistical analogs to Figures 1 and 2. The first two columns confirm for both successful and failed attacks that there are few significant differences between the default state (tranquility) and the crisis state in the year preceding the latter. Similarly, there are few significant differences between successful and failed attacks in the immediately preceding period. (Differences are evident only in the two measures of financial depth.) On the other hand, there are a number of significant differences in the year following the crisis (in the behavior of GDP growth, money growth, import growth, the real interest rate, and the ratio of M2/GNP).

Thus, we find that failure to successfully defend the currency against attack has real costs in terms of GNP. That post-crisis decline in growth is not obviously attributable to pre-crisis characteristics of the economy (compared to our control group of countries that successfully defend the currency against attack). The proximate source of that decline in growth in turn is the fall decline in consumption and rise in the risk premium, suggesting a deterioration in confidence. (The real exchange rate, export growth and the current account buffer these negative effects, but incompletely.) The acceleration of M1 growth and inflation suggest that it is involuntary loss of the monetary anchor and of monetary discipline that lies behind the deterioration in confidence.

III. Multivariate Analysis

The preceding comparisons are univariate. We now turn to multivariate analysis, drawing models from the literature on the determinants of currency crises.

Again, we ask whether the pre- and post-crisis behavior of output and other variables differs significantly depending on the success or failure of the defense; but we now control explicitly

for other characteristics of the economy. We estimate multinomial logit models linking the probabilities of successful and unsuccessful attacks to the control regressors. The null is that the evolution of the variables of interest are statistically distinguishable from one another before and after successful and unsuccessful defenses. We examine the variables of interest both the year preceding and the year following the event.

Tables 2 and 3 summarize the results of estimating a series of multinomial logit models by maximum likelihood. Table 2 contains estimates for three different specifications using data for the year *preceding* the crisis. Table 3 reports the same three specifications but using data for the year *following* the crisis. We report the coefficients and their associated z-statistics (the latter in absolute value terms).[20] Tranquility (i.e., observations which are not within three years of an attack) is the default cell; the coefficients therefore capture the differential impact of a variable on the probability of a successful or unsuccessful defense, compared to the tranquil default state.

The bottom of the table provides various diagnostics and hypothesis tests. The most important of these is the p-value for the test statistic that the coefficients for the successful and unsuccessful attacks are identical. A high number is consistent with the hypothesis, while a low one rejects it.

The default specification is at the left of the table: it includes growth, inflation, measures of monetary and fiscal policy and the current account.[21] The fit (as measured, for example, by

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[20]All slopes are multiplied by 100. Constants are included in the regressions but not recorded.

[21]This specification is not the result of extensive pre-testing; rather, we simply adopt the specification used to analyze the correlates of crises in Eichengreen and Rose (2000a). But, to establish robustness, we also display the results of estimating two additional specifications.

the R^2) is predictably unimpressive, consistent with the generally poor performance of leading-indicator models.[22] But what matters is that there continue to be few significant differences between successful and unsuccessful defenses prior to the event.[23] After the event, in contrast, economic performance differs: in particular, growth is slower following unsuccessful than successful defenses (see Table 3).[24]

The second pair of columns substitutes a trio of financial indicators as explanatory variables (the interest rate spread, the share of short term debt in total indebtedness, and the debt service -GDP ratio), while the third substitutes a pair of measures of external balance (the real exchange rate and reserve adequacy). In all cases the key results remain unchanged.

Table 4 quantifies the cost of a successful speculative attack. It reports the results of regressing the growth rate of real GDP on one-year lags of dummy variables for successful and unsuccessful speculative attacks and controls. If speculative attacks have no effect on growth rates after a year, then the coefficients on both dummy variables should be zero. We expect the coefficient on the lag of a successful attack to be negative, large, and significantly different from zero. Correspondingly, we expect the coefficient on successful defenses to be less important, both economically and statistically, and to differ significantly from the coefficient on successful attacks.

The first two rows show the coefficients on lagged successful and failed attacks, with

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[22]This is something we have emphasized elsewhere; see Eichengreen and Rose (2000b).

[23]We cannot reject the null that all of the coefficients are the same in the equations for successful and unsuccessful defenses at anything approaching conventional confidence levels.

[24]In this case we can reject the null that all of the coefficients are the same in the equations for successful and unsuccessful defenses at conventional confidence levels.

robust standard errors in parentheses. Our "default" specification controls for the effects of lags in growth, inflation, the government deficit/GDP ratio, and the growth rate of M1. (The next three specifications control only for lagged growth and, alternatively, for additional country characteristics and policies.)

Both hypotheses are supported. The coefficients indicate a significant negative effect on output in the case of unsuccessful defenses but not in the case of successful ones. The coefficients in question differ from one another at standard confidence levels.

The results thus suggest that the cost of a unsuccessful defense (relative to a successful one) is two to three percentage points of GDP.

IV. Sensitivity Analysis

In this section we report sensitivity analysis designed to gauge the robustness of our findings. We first consider a variety of perturbations of the basic methodology, and then implement a variety of further corrections for observable and unobservable heterogeneity.

Perturbations of the Methodology. In perturbing the basic methodology, we started with our default specification, which includes inflation, the budget and current account balances (relative to GDP, multiplied by 100), and M2/GDP. We then made the following changes.

- We substituted a one-year exclusion window to define periods of exchange market tranquility for our default three-year window.
- We added the IMF's bivariate measure of the presence or absence of capital controls to the default specification.
- We combined the benchmark explanatory variables with the financial variables and

alternatively, with the external sustainability variables.

- We excluded high-inflation observations (defined as countries with inflation in excess of 100 per cent per annum).
- We excluded OECD countries from the sample.

P-values are reported in Table 5 (where a low number indicates that we can reject the null of equal slopes for successful and unsuccessful attacks). It will be evident that none of these perturbations modifies the key finding that countries that successfully and unsuccessfully defend their currencies are indistinguishable prior to their crises. The evidence of a more severe post-crisis recession in countries which fail to rebuff the attack remains robust.

Other Sources of Heterogeneity. A potential objection to our results is that countries which fail to defend themselves against speculative attacks differ in ways that are not easily captured by standard macroeconomic and financial aggregates. These same unobservable characteristics could both make it more difficult for their governments to defend the currency against attack and lead to disappointingly weak economic performance in the subsequent period. For example, the Asian crisis has trained the spotlight on the importance of bank regulation for economic and financial stability. In this case the argument would be that a hidden problem of non-performing loans that does not show up in the statistics both makes it more difficult for a government to fend off a speculative attack (it is reluctant to raise interest rates and hold them at higher levels for fear of further aggravating the problems of an already weak banking system) and makes for a deeper recession following the collapse of the currency (since the banking system is in fact weaker than in countries which succeed in mounting a successful defense). It is not the success or failure of the defense per se that produces the different macroeconomic

outcome subsequently, in other words, but an omitted third variable (some other characteristic of the country that is difficult to observe by the econometrician) is responsible for both the failed defense and the subsequent recession.

These difficult-to-observe characteristics of countries are what the rating agencies are in business to detect. We therefore added to our specification the country credit ratings published in *Institutional Investor Magazine*.[25] We use annual averages of semi-annual ratings, which range from 0 at the bottom to 100 at the top.

Adding credit ratings changes little (see the second to the last row of Table 5). Although the raw credit ratings are somewhat higher for countries that succeed in defending their currencies against attack (not surprisingly), the difference is not significant once we control for observable macroeconomic and financial characteristics. Rating-agency intelligence does not suggest, in other words, that countries which succeed and fail to defend their currencies against attack differ significantly before the event in otherwise unobservable ways. Our first key result -- that countries which succeed and fail to defend themselves against a speculative attack are basically indistinguishable ex ante -- survives this extension. So does our second result: countries that are unable to defend themselves against the speculative attack continue to do significantly worse in the post-attack period even after we control for the difficult-to-quantify characteristics captured by their pre-attack credit ratings.[26]

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[25]A regression of these credit ratings on country characteristics (on annual data for the 1990s) yields an R-squared of 0.46 (Eichengreen and Mody, 1998). Thus, readily-quantified economic and financial conditions explain less than half of the variation in this measure, suggesting that it may add value.

[26]Following their crises, countries unable to mount successful defenses of course do worse both in terms of output and credit ratings. This reflects the tendency for ratings to follow actual performance.

It could be that in focusing on macroeconomic and financial variables, we have neglected important political determinants of both the ability of governments to defend their currencies against attack and the severity of the post-attack recession. Where the government lacks public support and is unable to credibly commit to policy reform, statements of readiness to, inter alia, raise interest rates to defend the currency will not be taken at face value. High interest rates may be seen as a sign of desperation rather than as a commitment to defend. And if such a government is then forced to abandon its exchange-rate commitment, doubts about its commitment to the pursuit of sound and stable alternative policies may lead to an unusually severe post-crisis recession. This is the story told of Indonesia following its 1997 crisis, for example. Again, the implication is that a third variable — in this case, political weakness — explains both the failure of the defense and the poor performance of the economy following the crisis; there is no direct connection between the success or failure of the defense and what comes after.

We therefore considered a series of political variables: whether the electoral system was proportional or majoritarian, whether the crisis occurred in an immediately before or after an election year, whether government was divided or the same party controlled all houses of the congress/parliament, whether the government was left or right wing, and whether the political system was presidential or parliamentary.[27] One finds in the literature on the political economy of exchange rate policy (e.g. Garrett 1998, Leblang 1997, Leblang and Bernhard 2000) arguments for why each of these variables should affect the ability to make credible commitments to defend the rate.

[27]We thank David Leblang for kindly providing these data.

Their introduction changed nothing. There are no statistically significant differences in these political variables either before or after the event.[28] Adding them reveals no statistically significant differences before the event in macroeconomic and financial variables. And their addition does nothing to weaken our finding of large differences in the post-crisis evolution of output as a function of whether or not defense of the currency was successful.

Some readers will worry that our benchmark specification, even augmented by country credit ratings and political variables, still does not capture ways in which countries that both were unable to defend their currencies and suffered post-crisis recessions subsequently differ from other countries.[29] We therefore applied an econometric treatment for unobserved heterogeneity. We estimated a first-stage probit regression designed to explain why some countries succeeded in defending themselves while others did not, constructed the Inverse Mills Ratio from the residuals of this equation, and added that ratio as an additional explanatory variable to our benchmark regression explaining post-attack economic performance. We modeled the success or failure of the defense as a function of inflation, the government deficit/GDP ratio, and M2/GDP. We use two variations to explain GDP growth. As in Table 4, our "default" specification controls for the effects of lagged growth, inflation, the government deficit/GDP ratio, and the growth rate of M1. The alternative specification controls for lagged output growth alone.

Our key finding survives this extension unscathed. As shown in Table 6, adding the

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[28]This is true whether we consider them individually in bivariate comparisons, or as a group in multivariate analysis.

[29]The criticism to which the rating agencies have been subjected for failing to predict recent crises provides some grounds for this suspicion.

Inverse Mills Ratio (ρ) to the regression for post-crisis economic performance does not alter the central finding that countries that fail to defend themselves against attacks grow more slowly subsequently.

V. Implications

Summarizing, we find that countries that are unable to defend their currencies against attack experience significant post-crisis output losses compared to countries that mount a successful defense. Those output losses are significant; we consistently obtain estimates on the order of 2 to 4 per cent of GNP. However plausible the assumption, we detect no evidence that countries which fail to sustain a successful defense and suffer post-crisis output losses enter their crises with greater economic, financial and political weaknesses than countries which succeed in repelling the speculative attack and avoiding post-crisis output losses. We do find plausible and significant differences in pre-crisis conditions in countries that do and do not experience speculative attacks but, to repeat, this is not the subject of our paper.

The output losses that follow failed defenses generally reflect a collapse of consumption, along with some fall in investment. That this takes place despite a decline in real interest rates clearly signals a negative shock to confidence, as does the post-crisis rise in risk premia in countries that involuntarily abandon their fixed rates. The rise in money growth and inflation in countries that fail to mount a successful defense is a strong hint of from where the shock to confidence is coming: namely, it reflects the decline in monetary discipline that follows the loss of the nominal anchor provided by the previously-prevailing exchange rate regime.

These results reinforce the findings of previous studies of exits from pegged exchange rates like Eichengreen and Masson et al. (1998). These authors analyze 29 exits by developing

countries from single currency pegs or basket pegs to managed exchange rates or independent floats. They find that growth is significantly lower in the year of the exit than in two control groups of countries: those that continued to peg without exiting, and all other developing countries in the World Bank data base. Our results are more refined in that the sample of exits is larger, that we limit the control group to other countries which also experienced speculative attacks but did not exit, and that we control for a variety of economic, financial and political characteristics of the countries experiencing crises. But the central conclusion of that previous study continues to hold: exiting involuntarily in response to a crisis is painful; it tends to result in significant output losses. It is better for countries seeking to move to greater exchange rate flexibility to do so voluntarily when the currency is strong rather than as the result of an attack.

This previous study speculated that loss of the nominal anchor — that is, of the exchange rate peg that provided the focal point for the country's monetary policy operating strategy — resulted in a loss of policy discipline and loss of confidence that compounded the crisis. Our paper provides evidence in support of this conjecture.

A final fact that emerges from our study is that defenses, like attacks, are heterogeneous.[30] This is evident in the relatively large two-standard-deviation bands that surround the macroeconomic and financial variables in Figures 1 and 2. The negative output effects of failed defenses may average three percentage points of growth, but they vary widely. Some recent cases — Brazil in 1998 springs to mind — are notable for having held these costs to lower levels. The popular explanation for their success is that they were quick to put in place an alternative monetary policy operating strategy: Brazil, for example, replaced its currency peg

[30]The heterogeneity of currency crises — that is to say, speculative attacks — was a theme of Eichengreen, Rose and Wyplosz (1995).

with an explicit inflation-targeting framework. There was no loss of monetary discipline, and the acceleration of inflation was minimal. The risk premium fell rather than rising, and consumption did not collapse. There can be no clearer example of what the authorities should do to minimize the costs of a failed defense.

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Table 1: Univariate Multinomial Logit Results

	Year Before		Year After	
	Successful	**Failed**	**Successful**	**Failed**
GDP Growth	-.02 (.02)	-.00 (.02)	**-.06** **(.02)**	**.01** **(.02)**
Consumption Growth	.00 (.02)	-.01 (.02)	-.06 (.02)	-.02 (.02)
Budget (% GDP)	-.05 (.03)	-.03 (.03)	-.08 (.03)	-.06 (.03)
M1 Growth	.001 (.004)	-.00 (.01)	**.004** **(.003)**	**-.01** **(.01)**
M2 Growth	-.001 (.002)	-.002 (.002)	**.000** **(.001)**	**-.01** **(.01)**
Interest Rate Spread	-.000 (.002)	-.002 (.003)	.000 (.002)	-.003 (.005)
Real Interest Rate	.01 (.01)	-.00 (.01)	**-.01** **(.01)**	**.02** **(.01)**
Current Account (% GDP)	-.04 (.02)	-.04 (.02)	-.02 (.02)	-.01 (.02)
Export Growth	-.01 (.01)	-.01 (.01)	.02 (.01)	.01 (.01)
Import Growth	-.00 (.01)	.00 (.01)	**-.02** **(.01)**	**-.00** **(.01)**
M2/GDP	**-.01** **(.01)**	**.002** **(.005)**	**-.01** **(.01)**	**.002** **(.005)**
M3/GDP	**-.01** **(.01)**	**.005** **(.004)**	-.01 (.01)	.001 (.005)
CPI Inflation	-.001 (.001)	-.001 (.002)	-.0001 (.0005)	-.01 (.01)
GDP Inflation	-.001 (.002)	-.002 (.002)	-.002 (.0005)	-.01 (.01)
M2/Reserves	-.01 (.01)	-.02 (.01)	-.03 (.02)	-.02 (.01)
Net International Reserves (% chg)	**-.008** **(.002)**	**-.000** **(.003)**	.005 (.002)	.005 (.002)
Real Effective Exchange Rate	.005 (.003)	-.003 (.006)	-.004 (.007)	-.004 (.005)
$ Exchange Rate (% chg)	-.000 (.004)	-.002 (.004)	**.008** **(.002)**	**-.004** **(.004)**
Short Term/Total Debt	.01 (.01)	-.01 (.01)	.00 (.01)	-.03 (.01)
Debt Service (% GDP)	.01 (.03)	.02 (.04)	.08 (.03)	.03 (.04)

Multinomial Logit regression coefficients (z-statistics). Default cell is tranquility.
Each row tabulates coefficients from two separate logits (before and after crises).
Three-year exclusion window (82 Successful, 85 Failed Attacks).
Intercepts not reported. Entries in **bold** with shading indicate that the coefficients differ between

successful and failed attacks at the 90% confidence level.

Table 2: Multivariate Multinomial Logit Results: Year *Before* Crises

	Successful	Failed	Successful	Failed	Successful	Failed
GDP Growth	-.04 (.04)	-.00 (.04)	-.07 (.04)	-.05 (.05)	-.15 (.05)	-.07 (.05)
Inflation	-.004 (.003)	-.004 (.003)				
Budget Deficit	-.08 (.04)	-.08 (.04)				
Current Account	-.03 (.04)	.02 (.03)				
M2/GDP	-.03 (.01)	-.02 (.01)				
Interest Spread			-.003 (.005)	-.001 (.004)		
Short Term/Total Debt			.05 (.02)	.03 (.03)		
Debt Service			-.03 (.04)	-.05 (.06)		
Real Effective Exchange Rate					.01 (.01)	-.00 (.01)
M2/Reserves					-.07 (.03)	-.03 (.02)
Observations		460		269		335
Pseudo-R^2		.05		.04		.06
Equality Test (P-value)		.67		.97		.29

Multinomial Logit Estimation: z-statistics in parentheses. Default cell is tranquility. Intercepts not reported Three-year exclusion window (82 Successful, 85 Failed Attacks).

Table 3: Multivariate Multinomial Logit Results: Year *After* Crises

	Successful	Failed	Successful	Failed	Successful	Failed
GDP Growth	-.15 (.03)	-.03 (.04)	-.14 (.04)	.06 (.05)	-.16 (.04)	-.02 (.05)
Inflation	-.001 (.001)	-.02 (.01)				
Budget Deficit	-.10 (.03)	-.11 (.04)				
Current Account	.04 (.03)	-.01 (.03)				
M2/GDP	-.03 (.01)	-.01 (.01)				
Interest Spread			-.002 (.004)	-.002 (.007)		
Short Term/Total Debt			.06 (.02)	-.001 (.03)		
Debt Service			.06 (.04)	-.02 (.05)		
Real Effective Exchange Rate					-.01 (.01)	-.00 (.01)
M2/Reserves					-.10 (.05)	-.03 (.02)
Observations	486		282		353	
Pseudo-R^2	.11		.08		.07	
Equality Test (P-value)	.01		.01		.07	

Multinomial Logit Estimation: z-statistics in parentheses. Default cell is tranquility. Intercepts not reported Three-year exclusion window (82 Successful, 85 Failed Attacks).

Table 4: Costs of a Successful Attack (Dependent Variable is Growth of GDP)

					Without High Inflation Obs	One-Year Window
Lagged Successful Attack	-3.19 (0.82)	-1.22 (0.59)	-3.76 (1.19)	-3.20 (0.83)	-3.06 (0.88)	-2.80 (0.72)
Lagged Failed Attack	-0.61 (0.64)	-0.09 (0.56)	-0.98 (0.92)	0.64 (0.66)	-0.81 (0.69)	0.11 (0.57)
Lagged Growth	0.36 (0.05)	1.91 (0.24)	0.39 (0.07)	0.35 (0.04)	0.36 (0.05)	0.36 (0.05)
Lagged Inflation	0.01 (0.01)		0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Lagged Budget Deficit	-0.02 (0.04)		-0.01 (0.04)	-0.01 (0.04)	-0.03 (0.05)	-0.02 (0.04)
Lagged Money Growth	-0.01 (0.01)		0.01 (0.01)	0.01 (0.01)	-0.01 (0.01)	-0.01 (0.01)
Lagged Current Account Def.			-0.05 (0.07)			
Lagged Interest Rate Spread			-0.01 (0.01)			
Capital Controls				-0.41 (0.29)		
R^2	0.17	0.20	0.22	0.17	0.17	0.16
n	1003	2501	580	983	903	1003

Note: constant terms estimated but not reported. Standard errors are in parentheses.

Table 5: P-values for test of equality of slopes for successful and failed attacks

	Year *Before* Crises	Year *After* Crises
One-year windowing	.73	.00
With IMF Capital Controls Measured Add	.53	.00
Benchmark + Financial	.89	.01
Benchmark + External	.84	.05
Without High Inflation Observations	.32	.01
Without OECD Observations	.73	.02
With Country Credit Rating Added	.45	.00

P-values: a low number indicates rejection of the hypothesis that the slopes for successful and failed attacks are identical. Default multinomial logit specification, with five macro regressors.

Table 6: Determinants of GDP Growth with "Heckit" correction

Output Growth lagged	0.36 (0.05)	0.36 (0.05)
Successful Attack lagged	-3.2 (0.79)	-3.2 (0.80)
Failed Attack lagged	-0.6 (0.5)	-0.6 (0.5)
Inflation lagged		0.000 (0.001)
Budget lagged (% GDP)		-0.01 (0.05)
M1 Growth lagged		0.001 (0.007)
Observations	889	885
P-value: Coefficients=0	0.00	0.00
ρ (s.e)	0.27 (0.12)	0.30 (0.13)

OLS Coefficients (corrected for selection) with robust standard errors.
Selection equation includes: inflation, M2/GDP, budget deficit (% GDP), and current account (% GDP).

Figure 1

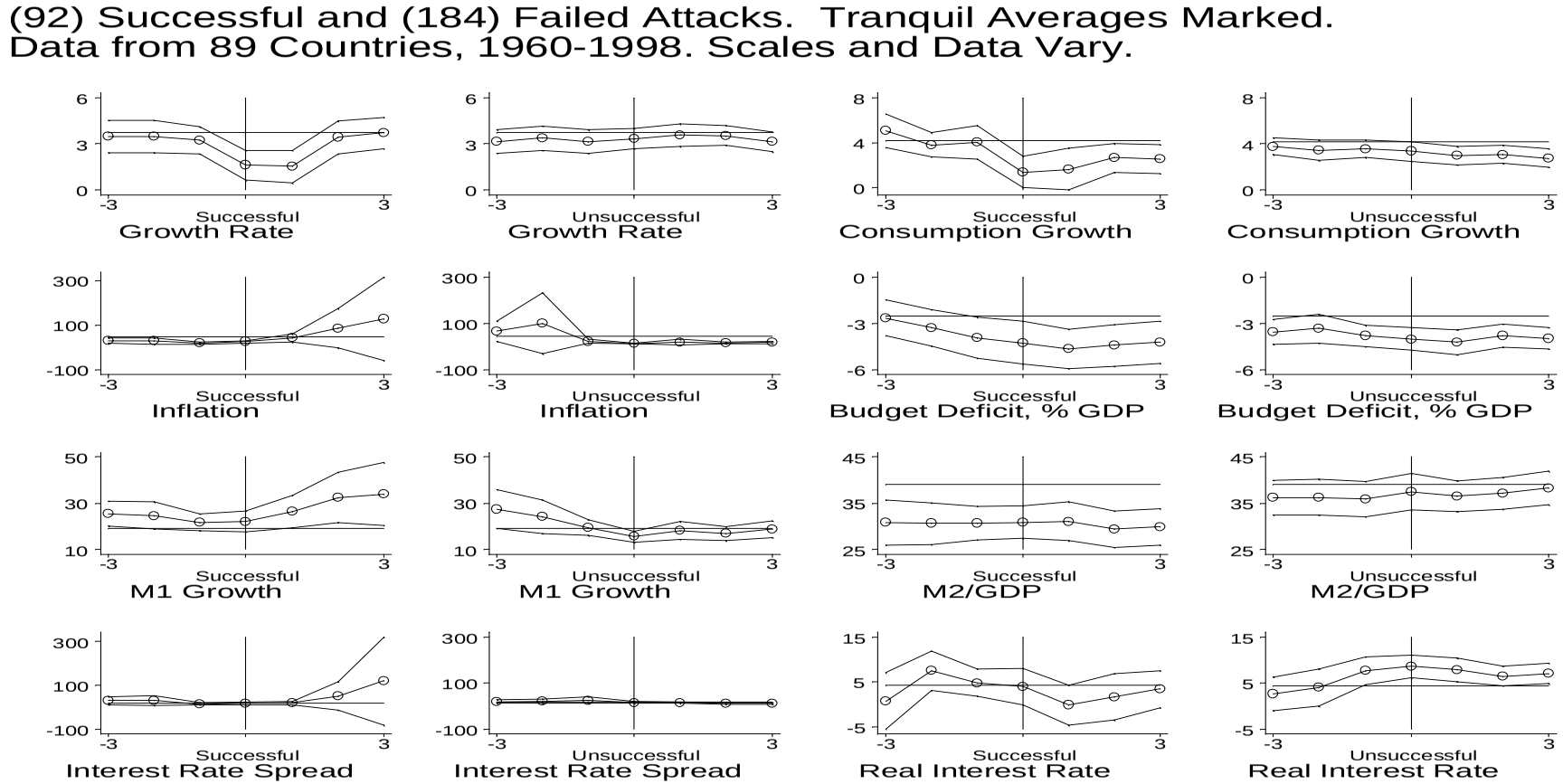
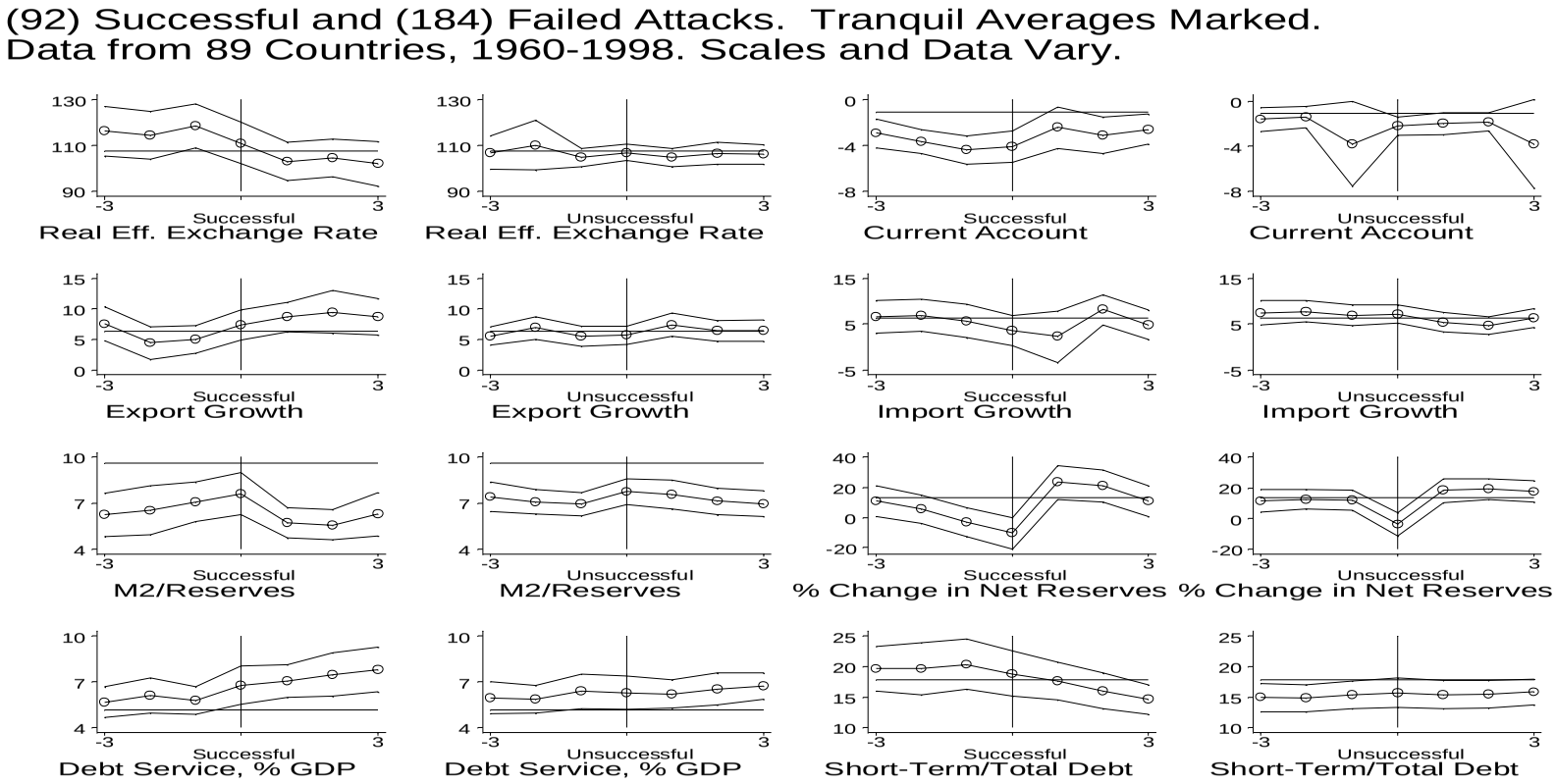

(92) Successful and (184) Failed Attacks. Tranquil Averages Marked.
Data from 89 Countries, 1960-1998. Scales and Data Vary.
Successful
Growth Rate
Unsuccessful
Growth Rate
Successful
Consumption Growth
Unsuccessful
Consumption Growth
Successful
Inflation
Unsuccessful
Inflation
Successful
Budget Deficit, % GDP
Unsuccessful
Budget Deficit, % GDP
Successful
M1 Growth
Unsuccessful
M1 Growth
Successful
M2/GDP
Unsuccessful
M2/GDP
Successful
Interest Rate Spread
Unsuccessful
Interest Rate Spread
Successful
Real Interest Rate
Unsuccessful
Real Interest Rate
Mean plus two standard deviation band; all figures are percentages.
Movements 3 Years Before and After Crises

Figure 2


(92) Successful and (184) Failed Attacks. Tranquil Averages Marked.
Data from 89 Countries, 1960-1998. Scales and Data Vary.
Real Eff. Exchange Rate
Real Eff. Exchange Rate
Current Account
Current Account
Export Growth
Export Growth
Import Growth
Import Growth
M2/Reserves
M2/Reserves
% Change in Net Reserves
% Change in Net Reserves
Debt Service, % GDP
Debt Service, % GDP
Short-Term/Total Debt
Short-Term/Total Debt
Successful
Unsuccessful
Mean plus two standard deviation band; all figures are percentages.
Movements 3 Years Before and After Crises