New Evidence on the Aftermath of Financial Crises in Advanced Countries

Christina D. Romer

David H. Romer

University of California, Berkeley

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Abstract

This paper examines the aftermath of financial crises in advanced countries in the postwar period. We construct a new series on financial distress in 24 OECD countries for the period 1967–2012. The series is based on assessments of the health of countries' financial systems from a consistent, real-time narrative source; and it classifies financial distress on a relatively fine scale, rather than treating it as a 0-1 variable. We find that the average decline in output following a financial crisis in modern advanced countries is statistically significant and persistent, but only moderate in size. More important, we find that the average decline is sensitive to the specification and sample, and that the aftermath of crises is highly variable across important episodes. A simple forecasting exercise suggests that the actual evolution of financial distress accounts for a substantial fraction of the variation in aftermaths. We find little evidence of nonlinearities in the aftermaths of crises; it is not the case that more severe crises have disproportionately negative aftermaths.

Christina D. Romer
Department of Economics
University of California, Berkeley
Berkeley, CA 94720-3880
cromer@econ.berkeley.edu

David H. Romer
Department of Economics
University of California, Berkeley
Berkeley, CA 94720-3880
dromer@econ.berkeley.edu

Even before the collapse of Lehman Brothers set off a worldwide financial meltdown, economists had shown renewed interest in financial crises. The experiences of Japan and the Nordic countries in the early 1990s and the East Asian crisis of the late 1990s had demonstrated that financial crises were not just a topic of historical interest. Scholars began to examine what previous experiences could tell us about the causes and effects of severe financial disruptions. Not surprisingly, the 2008 crisis added even greater urgency to this research agenda.

While researching the aftermaths of crisis is unquestionably important, it is also difficult. Before one can begin to evaluate what typically happens after a crisis, one has to know when crises occurred. But what counts as a "crisis" is far from obvious. It is natural to want to use a statistical indicator of financial distress, such as an interest rate spread or the change in lending. Such statistical measures have the benefit of being objective and capturing variations in the amount of financial disruption across episodes. But, they also have well-known disadvantages. Most obviously, they often do not exist on a consistent basis for a large sample of countries going back in time. More fundamentally, purely statistical indicators may misidentify financial disruptions. For example, financial distress may not show up in an interest rate spread if banks ration credit through quantity restrictions rather than price; or lending may decline because of tight monetary policy or falling output, rather than because of financial disruption.

Because of these problems, most studies have taken a different approach to identifying crises. Researchers have combined qualitative evidence from countries' financial histories with examination of more quantitative measures, such as government bailouts or bank failures, to date crisis periods. This approach has the ability to capture times of financial distress even when comprehensive statistical indicators do not exist or fail to reflect important financial market disruptions. But, it also has drawbacks. Most such crisis chronologies are a simple binary indicator, and so do not reflect the obvious fact that some crises are worse than others. The measures can also be flawed or difficult to interpret if imprecise criteria for what constitutes

a crisis are used, or if they combine diverse phenomena, such as asset price declines, banking problems, and consumer or business bankruptcies.

A New Measure of Financial Distress. In this paper, we create a new semiannual series on financial distress in 24 advanced countries for the period 1967 to 2012. As described in detail in Section I of the paper, our new measure is derived from contemporaneous narrative accounts of country conditions given in the Organisation for Economic Co-Operation and Development (OECD) publication, the *OECD Economic Outlook*. The definition of financial distress that underlies our new measure is that suggested by Bernanke (1983): a rise in the cost of credit intermediation. In this way, we focus on disruptions to credit supply, rather than on broader conceptions of financial problems.

We seek to avoid some of the potential drawbacks of more qualitative crisis series by using a precise definition of financial distress, focusing on a single real-time narrative source for a large sample of countries over an extended time period, and approaching the identification as systematically as possible. Like more statistical measures of financial problems, we use the narrative source not merely to identify crisis periods, but to scale the severity of financial distress. Thus we create an indicator that captures the variation in financial disruption across countries and time periods.

We find that the new measure identifies many of the same episodes as other crisis indicators. However, some crisis episodes included in other chronologies do not show up in our measure at all. And, the timing of financial distress is often quite different in our new measure than in the existing chronologies. More fundamentally, our scaled measure shows that episodes of financial distress differ greatly in severity and in the way that distress evolves over time.

While there are important benefits to relying on a single, consistent, real-time narrative source to identify financial distress, there are also limitations. For example, the source could be idiosyncratic or biased. We therefore check it against a wider range of real-time narrative sources. We find that it is reasonably accurate, but certainly not perfect. Moreover, while our

series contains information not captured by purely statistical indicators or other crisis chronologies, the fact that it is based only on narrative evidence suggests that those series may also contain information not captured by our series. Thus, each approach is likely to have value added relative to the other.

The Average Aftermath of Financial Crises. In Section II, we use our new measure of financial distress to investigate the typical aftermath of financial crises. Importantly, our narrative source does not provide enough information for us to be able to separate financial distress arising from a decline in output from financial distress occurring for more exogenous reasons. Thus, while our findings provide new evidence on what happens after crises, they contain at most only suggestive evidence of any causal impact of financial distress on real outcomes.

To estimate the average or typical aftermath of financial crises, we run straightforward panel regressions of real GDP on our new measure of financial distress. More specifically, we use the Jordà (2005) local projection method to estimate the response of GDP at different horizons to an innovation in the financial distress variable. We also examine the response of industrial production and unemployment.

Consistent with much of the existing literature, we find that in the aftermath of financial crises, real GDP falls significantly and persistently. Importantly, however, for advanced countries in the postwar period, the fall in output following a typical crisis is only moderate. The peak decline in real GDP is approximately 6 percent. The fall in industrial production and the rise in the unemployment rate are also statistically significant, but more modest in size. The estimate of the typical aftermath of financial crises using our new measure of financial distress is not dramatically different from that derived using existing crisis chronologies for the same time period and sample of countries.

When we consider alternative econometric specifications, the estimated negative aftermath of financial crises is noticeably smaller. For example, when we use generalized least squares to

take into account the fact that some countries generally have more variable output, the maximum decline in GDP is just 4 percent. Likewise, assuming that the contemporaneous relationship between financial distress and output reflects the effect of output on distress, and so should not be included as part of the aftermath, reduces the estimate negative outcome by a similar amount.

Variation in the Aftermath of Financial Crises. In some ways, focusing on the average aftermath of crises obscures the more fundamental issue of the variation in aftermaths. Section III explores this topic. We show that particular episodes are important outliers, and that excluding them changes the estimated average response substantially. For example, when we split the sample in 2007, the estimates for the earlier sample are somewhat smaller than those for the sample that includes the 2008 global financial crisis. Similarly, the decline in GDP in Greece following the 2008 crisis was so large that simply excluding Greece from the sample lowers the estimated average output decline following a crisis by more than a percentage point.

The second way that we investigate the variation in aftermaths is through a simple forecasting exercise. We compare an autoregressive univariate forecast conditional on information up though the year before significant financial distress with the actual behavior of GDP. We find substantial differences in these forecast residuals across countries and episodes. For example, GDP fell little relative to its pre-crisis path following the financial crises in Norway and the United States in the early 1990s, but dramatically following the crises in Japan in the 1990s and Turkey in the early 2000s. Such differences are even more pronounced in the 2008 episode, when many advanced countries suffered significant distress. Some countries, such as Norway, Austria, and the United States, show relatively small forecast residuals, while others, such as Iceland, Italy, Spain, Greece, and Portugal, show very large ones.

We go on to investigate the role that the severity and persistence of financial distress may play in accounting for the variation in aftermaths across episodes. We expand the simple forecasting framework for key episodes to include the actual evolution of distress throughout the

episode. This analysis shows that between a third and half of the variance of the univariate forecast error in these episodes can be accounted for by differences in financial distress itself.

We also investigate the possibility that the response of output to financial distress is nonlinear in the severity of distress. For example, perhaps extreme levels of distress have a disproportionately large effect on economic activity. To do this, we consider nonlinear permutations of the Jordà approach. In no instance are the nonlinearities large in either an economic or statistical sense.

Related Work. As described above, a large modern literature has developed on the identification and aftermath of financial crises. Caprio and Klingebiel (1996, 1999, 2003) did pioneering work on deriving a crisis chronology for a wide range of countries. Their crisis chronology is based in part on the retrospective assessments of experts on financial developments in various countries. Kaminsky and Reinhart (1999) is an early study comparing the behavior of output and other variables before and after the start of crises, compared with averages in "tranquil" times. Bordo et al. (2001) refine the Caprio and Klingebiel chronology, and also provide early estimates of the impact of crises.

Reinhart and Rogoff, in their influential book, *This Time Is Different* (2009a), and a number of related papers (see, for example, 2009b, 2014), also derive a crisis chronology, based in part on earlier studies. Using their chronology and an impressive range of outcome measures, they find important commonalities in both the run-up to crises and their aftermaths. In recent years, scholars at the IMF have refined the Caprio and Klingebiel dates using more precise criteria and some quantitative indicators (see Laeven and Valencia, 2014, for the most recent description of the IMF chronology). Recent work by Krishnamurthy and Muir (2016) investigates credit spreads as a possible indicator of financial disturbances, and finds a substantial correlation between this statistical measure of financial distress and common crisis chronologies.

Studies have investigated the behavior of the real economy following financial crises in a

variety of ways. Reinhart and Rogoff (2009a) look at the peak-to-trough fall in output per capita around crises. Bordo et al. (2001), IMF (2009a), Schularick and Taylor (2012), Jordà, Schularick, and Taylor (2013), and Claessens, Kose, and Terrones (2014) not only examine recessions around financial crises, but explicitly compare recessions with and without crises. These studies find that recessions accompanied by financial crises are more severe. Similarly, Claessens, Kose, and Terrones (2009) compare recessions with and without "credit crunches," where credit crunches are identified based on the magnitudes in the declines in credit. Hoggarth, Reis, and Saporta (2002), IMF (2009b), and Laeven and Valencia (2014) compare the path of output following crises with projections of pre-crisis trends. These studies find that output often falls far below the pre-crisis path, but that there is substantial dispersion across episodes.

A few studies use standard regression analysis of postwar data. Cerra and Saxena (2008) look at the behavior of output following the starting dates of the banking crises identified by Caprio and Klingebiel (2003). They find large and persistent falls in output after the onset of crises. Gourinchas and Obstfeld (2012), combining dates of banking crises from a range of existing chronologies, estimate updated versions of regressions analogous to the averages reported by Kaminsky and Reinhart (1999).[1]

Most studies consider banking crisis in samples that combine advanced and other countries. A few studies, such as Cerra and Saxena (2009), IMF (2009b), Gourinchas and Obstfeld (2012), and Claessens, Kose, and Terrones (2009, 2014), report results for advanced or high-income countries separately. In general, these studies find that though the aftermaths of financial crises are less severe in advanced countries, they are still quite poor. Schularick and

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[1] A study that is similar to ours in approach but that focus only on the United States is Jalil (2015). Jalil constructs a new series on banking panics for the United States back to the early 1800s using contemporary newspaper accounts. He scales panics into major and minor crises, and identifies a handful of panics that appear to have been caused by factors other than a decline in output. Using simple time-series regressions, he finds that crises have large and persistent real effects in the period before 1929. A study that focuses on the United States over both the prewar and postwar periods using more traditional business-cycle analysis is Bordo and Haubrich (forthcoming). They find that recoveries following financial crises are not slower than other recoveries.

Taylor (2012) and Jordà, Schularick, and Taylor (2013) look just at a sample of advanced countries, but over a very long sample period. They find substantial declines in output following crises, and also that the size of the credit boom preceding crises is an important predictor of the size of the decline.

I. NEW MEASURE OF FINANCIAL DISTRESS

The key contribution of this study is the derivation of a new scaled measure of financial distress for 24 advanced countries for the period 1967–2012.

A. Approach

Definition of Financial Distress. Conceptually, we think of financial distress as corresponding to increases in what Bernanke (1983) calls the "cost of credit intermediation." This cost includes both the cost of funds for financial institutions relative to a safe interest rate, and their costs of screening, monitoring, and administering loans and other types of financing. A rise in the cost of intermediation makes it more costly for financial institutions to extend loans to firms and households, and thus reduces the supply of credit. Importantly, we do not consider reductions in lending stemming from increases in all interest rates (as a result of tighter monetary policy, for example) as representing financial distress. The question of how monetary policy and the overall level of interest rates affect the economy is different from the issue of the aftermath of disruptions to the financial system, and we do not want to confound the two.[2]

Narrative Evidence. Following most previous work, we do not rely on statistical indicators of financial distress. Rather, we rely on more qualitative evidence about the health of the financial system to construct our index of financial distress. In particular, we use a careful analysis of a single, real-time narrative source to deduce times when the cost of credit

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[2] Bernanke also includes influences on credit flows and interest rates resulting from changes in the creditworthiness of borrowers in his definition of the cost of credit intermediation. Because our goal is to examine the aftermath of financial distress and because considering the creditworthiness of borrowers blurs the line between loan supply and loan demand, we focus only on the condition of financial firms.

intermediation rose. The use of contemporaneous accounts should help us avoid the natural tendency to perhaps look a little harder for a financial crisis before a known severe recession, or to identify the start of a crisis earlier than was apparent in real time. The use of a single source that covers many countries over a long period of time helps ensure consistency in the analysis across countries and episodes.

A second important feature of our measure is that we do not treat financial crises as a 0-1 variable, or divide crises into just two groups, such as minor and major or nonsystemic and systemic. Both logic and descriptions of actual episodes of financial distress suggest that financial-market problems come much closer to falling along a continuum than to being discrete events that are all of similar severities, or that fall into just a few categories. Treating a continuous variable as discrete introduces measurement error, both because the variation across crises is omitted and because a small inaccuracy in evaluating an observation can cause a large change in the value assigned to it.

Source. The particular real-time narrative source we use is the *OECD Economic Outlook*. This is a semiannual publication that describes economic conditions in each member country of the OECD at mid-year and year-end. The volumes have been published since 1967.

This source has several advantages. First, and most obviously, it is relatively high frequency, available over a long time period, and covers a large number of advanced countries. Thus it allows us to construct a measure of distress for a large sample over much of the postwar period. Second, the entries are analytical and of medium length (a typical entry is roughly 2000 words). As a result, they provide serious information in a relatively concise form. Third, the format, topics covered, and level of analysis appear to be relatively consistent both across countries and over time. Thus, the source can be used to derive a measure of financial distress for a number of countries that is similarly consistent across countries and time. Finally, financial conditions and determinants of credit growth are discussed routinely in the volumes from the beginning of the sample, and bank health is often mentioned. As a result, financial

distress is likely to be captured if it is present.

To have a relatively consistent sample and to keep the focus on advanced countries, we restrict the sample to the twenty-four members of the OECD as of 1973.[3] Given that the *OECD Economic Outlook* begins in 1967, that is the starting date of our analysis. We go through the second half of 2012, so that we capture the 2008 financial crisis.

B. <u>Implementation</u>

Methods. To derive our new scaled measure of financial distress, we read the *Economic Outlook* to see if OECD analysts described a rise in the cost of credit intermediation for individual countries. We put the most weight on factors that are clear markers for increases in the cost of intermediation. We look for discussions of such developments as increases in financial institutions' costs of obtaining funds relative to safe interest rates; general increases in the perceived riskiness of financial institutions; reductions in financial institutions' willingness to lend; disruptions in normal borrower-lender relationships that make it harder for financial institutions to evaluate prospective borrowers; and difficulties of creditworthy borrowers in obtaining funds because of problems at financial institutions.

In addition to looking for descriptions of factors directly linked to the cost of intermediation, we look for references to developments likely to weaken financial institutions, and so reduce their ability to perform their normal functions. Examples include rising loan defaults, increases in nonperforming loans, balance sheet problems, and erosion of their capital.

To scale the degree of financial distress, we attempt to group episodes that the *OECD Economic Outlook* describes in similar terms together, and to place ones that it describes as more severe in higher categories. In this grouping and ordering, we look for signs of more or less change in the indicators mentioned above. Was the rise in the perceived riskiness of financial institutions relatively minor, or so large that it is described as a widespread panic?

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[3] The countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

Was the effect on the willingness to lend described as minor or extreme? Was the rise in nonperforming loans thought to be small or large?

We also consider some indirect proxies for the size of the rise in the cost of intermediation. For example, we put some weight on descriptions of government intervention in the financial system as an indicator of the perceived severity of balance sheet and funding problems. However, we do not use this information mechanically. We try to take into account the fact that aggressive government intervention, rather than indicating a large rise in the cost of intermediation, might prevent any significant rise; or that greatly delayed intervention might clean up institutions that had long since become insolvent and whose lending activities had already been superseded by healthier institutions. Likewise, we tend to use discussions of widespread bank failures as an imperfect indicator of a more severe loss of confidence in financial institutions, and hence of a more dramatic increase in the cost of credit intermediation. We again try to be cognizant of the fact that institutions' cost of credit intermediation, and hence their ability to lend, can change greatly without their outright failure—particularly in the presence of regulatory forbearance, or of just enough government intervention to prevent outright failure. Finally, the OECD's descriptions of the actual or anticipated impact of financial troubles on spending and the economy are often a useful summary indicator for the perceived severity of financial distress.[4]

Criteria for the Different Categories. The categories to which we assign episodes have natural interpretations. Our main ones are "credit disruption," "minor crisis," "moderate crisis," "major crisis," and "extreme crisis." In keeping with the fact that the accounts suggest that financial-market problems fall along continuum, we subdivide each category into "regular," "minus," and "plus." Thus, for example, an episode of relatively minor financial distress could be classified as "credit disruption–minus," "credit disruption–regular," or "credit disruption–

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[4] Importantly, we see no evidence in the *Economic Outlook* that OECD analysts were deducing financial distress from declines in spending and output. Rather, they viewed distress as one influence on those outcomes.

plus." In our empirical work, we convert these categories into a numerical scale. Cases where there is no financial distress are assigned a zero. Positive levels of distress start at 1 for a credit disruption–minus and go through 15 for an extreme crisis–plus.

The hallmark of the episodes that we identify as credit disruptions is that the OECD perceived strains in financial markets, funding problems, or other indicators of an increase in the cost of credit intermediation that were important enough to be mentioned, but that it did not believe were having significant macroeconomic consequences. A common form for this to take was for the OECD to describe the problems not as directly affecting its outlook for the country, but as posing a risk to the outlook. Other possibilities are that the OECD viewed the problems as affecting only a narrow part of the economy; that it mentioned them in passing or explicitly identified them as minor; or that it described the financial system as improved but not fully healed following a situation that we classify as a minor crisis. An example of a regular credit disruption occurred in Germany in 1974:2 (that is, the second half of 1974), where the OECD described "strains" in the banking system and the extension of special credit facilities to help small and medium-sized companies obtain credit (OECD, 1974:2, pp. 50 and 26, respectively).

A canonical case of a minor crisis has three characteristics: a perception by the OECD that there were significant problems in the financial sector; a belief that they were affecting credit supply or the overall performance of the economy in a way that was clearly nontrivial, and not confined to a minor part of the economy; and a belief that they were not so severe that they were central to recent macroeconomic developments or to the economy's prospects. An example of a regular minor crisis is France in 1996:1, where the OECD described significant problems in the banking sector, including "high refinancing … costs and large provisions for bad debts," as well as government intervention to support some financial institutions, but did not give banking problems a central role in its discussion of the outlook (OECD, 1996:1, p. 78).

A moderate crisis, in our classification, involves problems in the financial sector that are widespread and severe, central to the performance of the economy as a whole, and not so serious

that they could reasonably be described as the financial system seizing up entirely. One specific criterion we use is whether the OECD mentioned the financial-sector problems prominently— for example, in the opening summary of the entry on a country. Another is whether the OECD discussed impacts on credit supply or real activity repeatedly. We also take descriptions of sizeable government interventions in the financial system as an indicator of a moderate crisis. Thus, our definition of a moderate crisis represents a quite significant level of financial distress, and appears to roughly correspond to the cutoff in other chronologies, such as Caprio et al. (2005), Reinhart and Rogoff (2014), and Laeven and Valencia (2014), between a systemic crisis and a nonsystemic crisis. An example of a regular moderate crisis is Sweden in 1993:1, where the *Economic Outlook* referred to "the capital bases of most major banks rapidly eroding," and said government rescue operations could cost up to 4½ percent of GDP (OECD, 1993:1, p. 115). It also said, "greater weakness of demand could be accentuated by rising capital costs in the event of larger loan losses" (OECD, 1993:1, p. 115).

At the severe end of the spectrum are major and extreme financial crises. These are situations where there are large impediments to normal financial intermediation throughout virtually all of the financial system. In identifying these episodes, we look for such markers as the unreserved use the term "crisis" in referring to the financial system, and for such terms as "dire," grave," "unsound," and "paralysis." We also look for clear-cut statements that the financial-sector disruptions were having an important effect on credit supply and macroeconomic outcomes. In addition, we view references to major government interventions as suggesting that the problems were severe. We find only a handful of major and extreme crises in our sample. An example is Japan in 1998:2, which we classify as an extreme crisis– minus. In that case, the OECD referred to the "breakdown in the credit creation mechanism," to "the severe and prolonged crisis in the banking system," and to banks being in "dire straits" (OECD, 1998:2, pp. 44, 20, and 45, respectively).

Our subdivision of the broad categories into minor, regular, and plus is based on the

specifics of the discussions within these general rubrics. In the case of credit disruptions, for example, we tend to place disruptions that the OECD described as posing major risks to the outlook in higher categories than ones that it viewed as posing minor risks. Similarly, if the OECD reported that a disruption was serious enough that it had caused authorities to make some type of intervention in credit markets to improve credit flows, we tend to classify the disruption as more serious.

__Documentation__. Online [Appendix A] provides more information about our criteria for the different categories of financial distress and our procedures for classifying episodes using the accounts in the *Economic Outlook*. Table 1 lists each episode for which we identify financial distress. The bulk of Appendix A provides episode-by-episode explanations of the analysis and discussion in the *Economic Outlook* that lead to our classifications. Thus, it should enable others to check our interpretation and classification of the narrative accounts. Exhibit 1 reproduces the appendix entries for the four episodes cited above: Germany in 1974:2 (credit disruption–regular), France in 1996:1 (minor crisis–regular), Sweden in 1993:1 (moderate crisis–regular), and Japan in 1998:2 (extreme crisis–minus).

C. __New Series__

The semiannual publication of the *OECD Economic Outlook* means that our new measure is semiannual as well. Figure 1 shows our new measure of financial distress for the period 1967:1 to 2012:2 for all 24 countries in our sample.

Several features are clear from the figure. Most obviously, there were essentially no episodes of financial distress, and certainly nothing that would count as a significant crisis, in the 1970s and 1980s. For advanced countries, these two decades were a time of financial calm, despite oil price shocks and severe moves toward disinflation in many countries.

The 1990s, in contrast, were a period of significant financial distress. Our new measure captures the well-known financial troubles in a number of Nordic countries and Japan in this

period. It also identifies significant distress in the United States at the turn of the decade related to the savings and loan crisis and other disruptions. An important characteristic of distress in the 1990s was the fact that it was relatively uncorrelated across countries: crises in this period typically affected just one, or at most a few, countries at a time.

The 2008 episode obviously stands out as a period not only of substantial financial distress, but also of highly correlated distress. Literally every country in our sample experienced at least some financial distress in this episode. In the United States and Iceland, it was extreme—roughly equivalent to the level experienced by Japan in 1998. In many other OECD countries, distress was on a par with that of the Nordic countries in the early 1990s. And some countries, such as Australia, Canada, and Japan, experienced only relatively minor distress.

Another thing that is clear from the figure is the tremendous variation in how crises evolve. Some, such as the crisis in Sweden in 1992–1993, became acute almost instantaneously, and then resolved just as quickly. Others, such as the distress in Japan in the 1990s and early 2000s, built slowly before eventually erupting into severe distress. Japan also stands out as a case where the financial distress lingered—not just for years, but for well over a decade. In other episodes, such as France in the mid-1990s, a country may suffer mild distress for a prolonged period, but never have it erupt into a full-fledged crisis. And, in the 2008 crisis, there was, if anything, even greater variation across countries in the severity and evolution of financial distress.

D. Comparison with Other Chronologies

It is natural to ask how our new measure of financial distress compares with other crisis chronologies for the same countries over the period we consider. We focus on two alternatives: the latest version of crisis dates from Reinhart and Rogoff and from the IMF Systemic Crisis Database.[5] The Reinhart and Rogoff chronology is available for the full period we consider

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[5] The Reinhart and Rogoff dates are an updated version of those in Reinhart and Rogoff (2009a), and are available at www.carmenreinhart.com/user_uploads/data/213_data.xls. We supplement these dates with

(1967–2012); the IMF chronology is available for 1970–2011. Since our new series is semiannual, we convert these alterative chronologies to semiannual as well.[6] Reinhart and Rogoff identify systemic and non-systemic crises separately; the IMF focuses only on systemic crises, though they identify some episodes as "borderline" (Laeven and Valencia, 2013, p. 232).

As discussed above, in our new scaled measure of financial distress, a value of 7 corresponds roughly to a moderate or systemic crisis. There are six episodes before 2007 when our new measure reaches 7: Finland, Norway, and Sweden in the early 1990s; Japan in the 1990s and early 2000s; Turkey in the early 2000s; and the United States around 1990. Those same six episodes show up in the Reinhart and Rogoff and IMF chronologies, though Reinhart and Rogoff list the U.S. episode around 1990 as non-systemic.[7] The alternative chronologies also identify systemic crises in two episodes when our new series shows no financial distress at all: Spain in the late 1970s and early 1980s and Turkey in 1980s. Thus, an important difference between our new series and the alternatives is the absence of these two episodes.

Figure 2 compares the three crisis series in the six episodes before 2007 when our new measure reaches a value of 7. The Reinhart and Rogoff crisis start and end dates are shown by red vertical lines; the IMF dates are show by blue vertical lines; and our new series is shown as a time series in green.[8]

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information from Reinhart and Rogoff (2009a), Table A.4.1, pp. 348–392, which sometimes provides a specific month for the start of a crisis. For Ireland and Switzerland, we use information provided by Carmen Reinhart in correspondence. The IMF crisis dates are from Laeven and Valencia (2013), Table A1, pp. 254–259. Months for the start date are taken from the data spreadsheet accompanying the paper, available on the *IMF Economic Review* website, http://link.springer.com/article/10.1057/imfer.2013.12. The spreadsheet gives both a baseline start date and the date at which the crisis became systemic. In our figures, we show the baseline date, but provide a note if the date at which the crisis became systemic was different.

[6] If a month is given for the start of the crisis, we date it in whichever half-year the month occurs; if no month is given, we date it as occurring in the first half of the year. For Reinhart and Rogoff crises dated 2007 and 2008 (which 2009a, Table A.4.1 does not cover) we place the date in the second half of the year (which parallels the dating in the IMF chronology for these years). Months are not given for the end dates of crises in either chronology. We follow the convention of always dating the end in the second half of the year.

[7] Reinhart and Rogoff also identify another 15 non-systemic crises in our sample of 24 OECD countries in the period 1967–2012.

[8] Reinhart and Rogoff (2009a) place much more emphasis on the start dates of crises, so their end dates may be less meaningful.

A few general characteristics are evident in Figure 2. The Reinhart and Rogoff start dates for crises tend to be decidedly earlier than the IMF start dates, and often before our new measure identifies any rise in financial distress. The IMF start dates tend to align fairly well with the start of spikes in our new measure.[9] The end dates for the two alternative crisis chronologies vary both with each other and with our new measure. In some cases, the end date comes well after our new measure shows no financial distress. In others, our new measure shows distress continuing—sometimes at substantial levels—well after the alternative chronologies indicate the crisis has ended.

In the post-2007 period, our new measure reaches at least 7 in 13 OECD countries. Reinhart and Rogoff and the IMF identify crises in twelve of these same countries; neither alternative chronology identifies a crisis in Norway during this period. Of the twelve cases where all three measures identify a crisis, the IMF lists four as borderline (France, Italy, Portugal, and Sweden), and Reinhart and Rogoff identify one as non-systemic (Sweden). Both alternative chronologies list Germany as having a systemic crisis in this period; but since our new measure reaches a 6 in Germany, this is not a major discrepancy. The IMF identifies a systemic crisis in the three Benelux countries (Belgium, Luxembourg, and the Netherlands) around 2008; Reinhart and Rogoff identify a systemic crisis in the Netherlands and a non-systemic crisis in Belgium (Luxembourg is not in their sample). While our measure shows some financial distress in these countries, it does not reach the moderate crisis range—peaking at 5 in Luxembourg and at 4 in the other countries.[10]

Figure 3 presents the three crisis measures for six selected countries in the post-2007

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[9] The one obvious exception to this pattern is in the U.S. episode (panel f), where the IMF dates the crisis as occurring just in 1988, whereas the new measure shows distress in 1990 and 1991. We suspect that this difference stems largely from the fact that the IMF crisis identification methods place particular weight on when government bailouts occurred, whereas our measure focuses on when the cost of credit intermediation rose.

[10] As with the U.S. episode shown in Figure 2, some of the difference between the other chronologies and our measure for the Benelux countries appears to reflect the other chronologies' greater emphasis on government bailouts in the identification of crises.

period where our new measure reaches at least 7.[11] In most cases, the Reinhart and Rogoff and IMF start dates for the crisis are identical. In general, they also align reasonably well with when our new measure spikes up.

The IMF chronology ends in 2011:2. As of then, the IMF had not identified the end of the crisis in any country. The Reinhart and Rogoff dates go through 2014, but as of then, they had dated the end of the crisis only in the United States and Sweden (both 2010:2). Our new measure agrees that distress in both these countries had returned to zero by 2011:1. We also find that distress was very low in a number of other countries by the end of 2012.

One feature that stands out in Figure 3 is the variation in country experiences shown by our new measure during the 2008 episode. Figure 3 only shows cases where distress reached at least 7. Even so, one can see a large range of peak distress: countries such as France never went above 7; the United States and Iceland went to 14. There was also important variation in the evolution of distress. The three countries where distress was most acute in 2008 (Iceland, the United Kingdom, and the United States) saw distress essentially end by 2011 or 2012. Other countries, particularly Greece, Ireland, Italy, Portugal, and Spain, where distress was only moderate in 2008, experienced a second rise in 2010 or 2011, and distress had not dissipated by the end of our sample in 2012:2.

E. **Additional Narrative Evidence on the Accuracy of the New Series**

As we have described, we view our new series on financial distress as having important strengths. But, of course, it has limitations as well. Three seem potentially most important.

First, our reliance on a single narrative source means that our series is subject to idiosyncratic errors. For example, OECD analysts might have accidentally overlooked evidence of distress in an episode, or might have seen evidence of minor distress but judged it not important enough to mention at all in a brief entry. And, the fact that much of the discussion in

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[11] Figure C1 of online Appendix C shows the figures for the other seven countries where our measure reaches 7 in the post-2007 period.

the *OECD Economic Outlook* is qualitative means that our translation of its accounts into a scaled measure could be flawed, and so introduce errors into our measure. Second, our real-time source could have systematic biases. For example, perhaps the OECD analysts lacked the expertise needed to assess financial distress, especially in the early decades of our sample. Or perhaps the OECD consistently downplayed distress to try to assuage country representatives or out of fear that it could worsen conditions or precipitate a crisis. And third, our use of real-time accounts means that we cannot bring in information that was not available at the time, but that is useful in determining the extent of distress in retrospect.

Additional Sources and Approach. To shed some light on these possibilities, we compare the evidence from the *OECD Economic Outlook* with that from three other real-time narrative sources: the annual reports of the relevant central banks, the staff reports from the IMF's Article IV consultations, and the *Wall Street Journal.* While there is overlap among the sources—for example, the IMF consults with the central banks—each appears to contribute valuable independent information. The central banks are particularly focused on financial conditions, and so are likely to provide more detailed reports on credit supply disruptions. The IMF reports were typically confidential and often quite frank, so it seems particularly unlikely that they were reluctant to describe financial problems. And the articles in the *Wall Street Journal* are likely similarly free of any potential sugarcoating, and have the shortest lags between developments in the financial sector and publication. Importantly, all the narrative sources often cite information about such variables as interest rate spreads, nonperforming loans, and government bailouts. Thus, they provide information about real-time quantitative evidence as well—and also about whether analysts at the time viewed movements in those variables as indicating disruptions to credit supply.

To keep the analysis of the additional sources manageable, we examine them only in key episodes. For the period before 2007, we focus on the six episodes where our new measure reaches a value of 7, as well as the two episodes where our new series shows no financial

distress, but the traditional chronologies identify a systemic crisis. For the period after 2007, we focus on the one case where our new measure reaches 7, but the alternative chronologies do not identify a crisis of any sort (Norway), and the one case where the alternative chronologies both identify a systemic crisis, but our new measure shows only a relatively modest increase in financial distress (the Netherlands).

Online Appendix B provides a detailed episode-by-episode discussion of this additional evidence. Here, we summarize the results of this analysis.

Findings. One important finding involves methodology. Examining the additional narrative sources strengthens the case for a continuous measure of financial distress rather than a 0-1 crisis classification. Like the OECD, the other real-time sources described a range of financial troubles in the various countries at different times. While it is clear that financial distress was worse in some half-years than others, it is often very hard to see where one would draw the line between a "crisis" and not. This is particularly obvious in the case of Japan. Like the OECD, the additional sources described growing financial troubles over the early and mid-1990s; much more severe problems in the late 1990s; improvement and then another round of severe distress in the early 2000s; then, finally, gradual recovery in the mid-2000s. Attempting to reduce this complex experience to a limited period of crisis would be both difficult and counterproductive.

For the period before 2007, the descriptions in the additional sources are typically in fairly close agreement with our new series. The agreement is most noticeable in the cases where the timing of crises in the new series differs most from the alternative chronologies. For the United States, the additional sources agree with the new measure that distress was concentrated in the early 1990s, and not significant in the mid-1980s as Reinhart and Rogoff suggest or confined to 1988 as the IMF chronology places it. Likewise, for Japan, the other real-time sources agree with the new measure derived from the *OECD Economic Outlook* that there was some distress over almost all of the period 1990:1 to 2005:1, that distress was not high until about 1995, and

that distress peaked in 1998 and 2002. This is quite different from the Reinhart and Rogoff chronology, which shows a full-blown crisis starting in 1992, and from both alternative chronologies, which show distress ending in 2001. Finally, for Norway, where Reinhart and Rogoff identify the start of problems in 1987, while the new series and the IMF chronology date it in late 1991, the additional sources support the later date.[12]

In the episodes where there are smaller differences between the new series and the alternative chronologies in the pre-2007 period, we again do not find large differences between the *OECD Economic Outlook* and the other real-time narrative sources. However, the analysis shows that the OECD was occasionally somewhat slower to identify the start of financial distress. Because the alternative chronologies also tend to date crises somewhat earlier than the OECD, in these instances the additional evidence may be more supportive of them. At the same time, the early distress described in the additional sources is often relatively limited, and thus perhaps not consistent with the start of a full-fledged crisis. On the end of financial distress, the differences between the evidence in the additional sources and the new series are not systematic, nor typically in the direction of the alternative chronologies. And because all four real-time sources suggest at least somewhat gradual changes, even where there are disagreements about when distress reached zero, there is close accord that distress was low and falling.

For the two early cases where Reinhart and Rogoff and the IMF identify a crisis while the new series shows no financial distress—Spain in the late 1970s and early 1980s and Turkey in the 1980s—the additional real-time sources generally support the new measure for the first and are somewhat mixed for the second. For Spain, the IMF Article IV reports, like the OECD, described no distress, and the other two sources reported only occasional mild problems. In the

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[12] Importantly, while the additional evidence in these cases corroborates the new measure, it also often provides clues as to why the alternative chronologies date crises as they did. For example, the records of the Federal Reserve showed a small amount of concern about the banking system in 1984 and 1985 when Reinhart and Rogoff date the start of the crisis. Similarly, the Norges Bank discussed minor financial problems in 1987, the start date of the Norwegian crisis in the Reinhart and Rogoff chronology. In both cases, however, the additional sources were quite clear that they did not believe the problems to be of crisis proportions.

case of Turkey, all three additional sources described significant distress—thus conflicting with the new measure. However, the accounts in the additional sources are noticeably milder than in episodes where all the chronologies identify a crisis, such as the Nordic countries in the early 1990s—thus supporting a view between that of the alternative chronologies and the new measure derived from the *OECD Economic Outlook*.

For the two cases after 2007 for which we analyze the additional sources (the Netherlands and Norway), those sources suggest our new measure of financial distress derived from the *OECD Economic Outlook* is again reasonably accurate, but not perfect. The additional sources are very supportive of the timing of distress shown by our measure. For the Netherlands, they show a peak in distress in 2008:2 and 2009:1, which is precisely when our measure shows notable distress. For Norway, the additional sources, like our measure, show a very sharp, concentrated rise in distress followed by a quick resolution—though they suggest the distress was, if anything, even more short-lived. The additional sources are not consistent with the view of the alternative chronologies that a systemic crisis in the Netherlands continued into 2010.

The alternative sources are less supportive of the peak levels of distress that we identify from the *OECD Economic Outlook*. In the Netherlands we identify a minor crisis–minus, while in Norway we identify a moderate crisis–plus. The additional evidence agrees that there was significant financial distress in both episodes. However, it points clearly to greater distress than we identify from the *Economic Outlook* for the Netherlands, and probably to slightly less than we identify for Norway. However, because our measure is continuous, even if the alternative sources are completely correct, the implied errors in our series are only moderate.

Interpretation. The evidence from the key episodes described here and in online Appendix B shows a relatively high correlation between the extent and timing of financial distress described in the *OECD Economic Outlook* and the accounts in other real-time sources. Thus, our series derived from the *Economic Outlook* appears to be a reasonably good summary of what a range of real-time sources indicate about financial distress.

In addition, the very different processes through which the sources are produced and the specifics of how they describe conditions in various countries provide evidence against the hypothesis of major common biases across all the real-time sources. As we document in online Appendixes A and B, throughout our sample period all four sources often described various types of disruptions in credit markets or developments that correspond to increases in the cost of credit intermediation; this casts doubt on the idea that they systematically overlooked financial distress or lacked the expertise needed to convey evidence of it. And as we also document, it was not unusual for at least some of the sources to raise the possibility of a sudden loss of confidence in some aspect of a country's economy; thus, although we cannot rule out some role of political pressure, it does not appear pervasive.

At the same time, there are cases where our measure based on the *OECD Economic Outlook* differs somewhat from what the other real-time sources suggest. And, we cannot entirely rule out the possibility of some common bias across the four real-time sources, or of important information that only became available ex post.[13] The conclusion we draw is simple: both our measure and the traditional series have value added relative to each other.

II. THE AVERAGE AFTERMATH OF FINANCIAL CRISES

Having created a new, continuous measure of financial distress for a sample of advanced countries, the obvious next step is to see what it reveals about the aftermath of financial crises. In this section, we consider the average or typical aftermath; in the next section, we analyze the variation in outcomes across episodes.

A. Data and Specification

Data. Our primary focus is on the behavior of real GDP following financial distress. Real

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[13] One case where there appears to be at least some common error is Spain in the late 1970s and early 1980s: ex post accounts show somewhat more distress than any of the real-time sources (though not as much as in the pre-2007 episodes that reach 7 or more on our scale). We discuss this evidence further in online Appendix B.

GDP has the virtue of being the broadest indicator of real economic activity. Its downside is that it is difficult to measure, and so may be less consistent in both quality and methodology across countries. For this reason, we also consider two other indicators of real economic activity: industrial production and the unemployment rate. All three series are available quarterly from the OECD for the 24 countries in our sample.[14]

Our measure of financial distress is semiannual. We therefore convert the outcome data to semiannual as well. We do this by taking the quarterly values for the second and fourth quarters of each year. Since the *OECD Economic Outlook* is issued at mid-year and at year-end, the timing of the output data roughly corresponds with the timing of the OECD's descriptions of country conditions. In this way, we create a panel dataset including real GDP, industrial production, the unemployment rate, and the new distress variable for the 24 OECD countries we consider starting in 1967:1.

Specification. An important issue in estimating the average aftermath of financial crises is the treatment of the contemporaneous relationship between economic activity and financial distress. In deriving our new measure, we have sought to identify the timing and severity of financial distress consistently and accurately. But our analysis tells us nothing about the ultimate cause of the distress. In particular, our source does not allow us to separate distress caused by relatively exogenous factors, such as managerial malfeasance, from financial

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[14] The data, which are ultimately collected and reported by the individual countries, are available on the OECD website: http://www.oecd.org/statistics/. The GDP data are from the Quarterly National Accounts Dataset, series VPVOBARSA. The industrial production data are from the Production and Sales Dataset, production of total industry. The unemployment data are from the Main Economic Indicators Dataset, harmonized unemployment–monthly rates, total, all persons. The GDP and industrial production series were downloaded 7/21/2016; the unemployment data were downloaded 8/16/2016. All series are seasonally adjusted. There are some minor gaps in the two output series for some countries. Real GDP data are missing for Iceland before 1997Q1 and for Greece after 1999Q4. Industrial production data are missing for Australia before 1974Q3; Denmark before 1974Q1; Iceland before 1998Q1; Ireland before 1975Q3; New Zealand before 1977Q2; and Turkey before 1985Q1. The unemployment data do not go back to the beginning of the sample for most countries. Earlier unemployment data for many of these countries (attributed to the OECD) are available from the Federal Reserve Bank of St. Louis, Federal Reserve Economic Data (FRED): https://fred.stlouisfed.org/. We ratio splice these earlier data to the data from the OECD website in the first half-year the OECD data are available. Even doing this, the unemployment rate is missing for about a quarter of our observations. However, it is available for all of the episodes where distress reaches 7 other than Turkey in the early 2000s.

problems caused or exacerbated by a cyclical downturn or by forces that reduce economic activity directly. As a result, the appropriate treatment of the contemporaneous relationship between economic activity and distress is ambiguous.

Following the spirit of the previous literature, in our baseline specification we include the contemporaneous relationship between economic activity and financial distress as part of the aftermath of a crisis. (In conventional causal terminology, this corresponds to assuming that distress is not affected by economic activity contemporaneously, but economic activity may be affected by distress within the period.) In Section II.C, however, we investigate the sensitivity of our results to alternative treatments of the contemporaneous correlation.

To identify the typical behavior of economic activity in the wake of distress, we use the Jordà (2005) local projection method to estimate of the impulse response function of economic activity to financial distress. The particular specification that we estimate is:

(1) $$y_{j,t+i} = \alpha_j^i + \gamma_t^i + \beta^i F_{j,t} + \sum_{k=1}^{4} \varphi_k^i F_{j,t-k} + \sum_{k=1}^{4} \theta_k^i y_{j,t-k} + e_{j,t}^i,$$

where the j subscripts index countries, the t subscripts index time, and the i superscripts denote the horizon (half-years after time t) being considered. $y_{j,t+i}$ is a measure of economic activity (real GDP, industrial production, or the unemployment rate) for country j at time $t+i$.[15] $F_{j,t}$ is the financial distress variable for country j at time t. We include four lags of both the distress variable and the economic activity variable as controls. We also include country fixed effects (the α's) to capture the fact that the normal behavior of the outcome measure may differ across countries. Similarly, we include time fixed effects (the γ's) to control for economic developments facing all countries in a given year.

We estimate equation (1) using ordinary least squares (OLS) for values of i from 0 to 10 half-years. That is, we consider horizons up to five years after time t. For our baseline results,

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[15] When using an output measure as the outcome variable, we take logarithms; the unemployment rate is entered in levels.

we estimate (1) for our sample of 24 OECD countries for the full time period. Because our new measure of distress begins in 1967:1, the inclusion of four lags means that our sample period begins in 1969:1. We carry the estimation through the latest date for which all of the needed data are available.[16] The sample end dates will thus vary depending on the horizon being estimated. In Section III, we discuss the sensitivity of the estimates to the sample of countries and the time period used.

The sequence of coefficients on the financial distress variable at time *t* for successive horizons shows the behavior of economic activity in response to an innovation in the distress variable of 1. To make the interpretation of the impulse response function more straightforward, we multiply the coefficients by 7, which is the value of our distress measure corresponding to the start of the "moderate crisis" category. This transformed impulse response function thus shows the behavior of economic activity following a relatively large impulse in financial distress.

Throughout the paper we consider numerous alternative specification choices. In each case, online [Appendix C] provides details of the alternative estimation procedures and the associated results.

B. Baseline Results

We estimate equation (1) for the various horizons using each of the three outcome variables. For GDP and industrial production, the sum of the coefficients on lagged output is close to one, even at quite distant horizons. As a result, the country fixed effects essentially capture differences in average growth rates across countries. The hypothesis that the country fixed effects are all zero is strongly rejected for all three outcome measures at all horizons. Similarly, the hypothesis that the time fixed effects are all zero is overwhelmingly rejected for all outcome measures at all horizons.

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[16] The data for the outcome variables are available in most cases through 2015:2. Though our new measure of financial distress is only available through 2012:2, in estimating the responses at longer horizons, we make use of the outcome data through 2015:2.

Impulse Response Functions. Figure 4 shows the impulse response functions for the three outcome series estimated over the full sample of 24 advanced countries, together with the two-standard-error bands. Panel (a) shows the results for real GDP. GDP appears to fall contemporaneously with the impulse in the financial distress variable. The immediate aftermath of a moderate crisis is a fall in GDP of 2.1 percent ($t = -6.2$). This decline grows substantially over the 3½ years following the impulse, peaking at 6.0 percent ($t = -5.3$). While the estimated negative aftermath begins to wane after 3½ years, it remains large: after 5 years, the decline in GDP is 4.3 percent ($t = -3.3$).

The impulse response function for industrial production is shown in panel (b) of Figure 4. It, too, shows that output falls contemporaneously with the innovation in distress. The immediate aftermath of a realization of 7 in our new measure of financial distress is a fall in industrial production of 2.2 percent ($t = -3.5$)—very similar to the contemporaneous decline in real GDP. In contrast to the results for GDP, however, industrial production appears to recover substantially over the subsequent 2 years, before falling again for a while. None of the estimated declines after horizon 2 (that is, one year after the innovation in distress) is significantly different from zero.

Panel (c) shows the impulse response function for the unemployment rate. Contemporaneous with the impulse to distress, the unemployment rate rises 0.5 percentage points ($t = 4.9$). As with GDP, the undesirable aftermath increases steadily through 3½ years following the impulse, peaking at 2.1 percentage points ($t = 4.7$). Also similar to GDP, the increase in the unemployment rate begins to wane after 3½ years, falling to 1.3 percentage points ($t = 2.5$) 5 years after the shock to distress.[17]

Interpreting the Results. Overall, the results concerning the typical aftermath of a financial crisis in advanced economies largely confirm the conventional wisdom. For all three

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[17] The impulse response functions in Figure 4 are estimated using the Jordà local projection method. Figure C2 of online Appendix C shows that the results estimated using a conventional vector autoregression are virtually identical.

real outcome measures, economic activity declines significantly following a substantial rise in financial distress, and for GDP and unemployment the effects are highly persistent.

At the same time, the magnitude of the economic contraction following a financial crisis is somewhat different across the three indicators. The maximum fall in real GDP (relative to what it otherwise would have been) is 6 percent. This is comparable to the largest recessions in the United States in the postwar period. The maximum fall in industrial production, on the other hand, is a remarkably modest 2.8 percent. To put that decline into perspective, Romer and Romer (1989) find that industrial production fell roughly 12 percent following relatively exogenous shifts to contractionary monetary policy in the United States in the postwar period. Finally, for the unemployment rate, the maximum increase is 2.1 percentage points, which is about the size of an average postwar recession in the United States. Taking the three indicators together, the average aftermath of a financial crisis is probably best described as medium-sized—that is, bad but not terrible.

In assessing the magnitude of the average negative aftermath of financial crises, it is important to recall that some financial distress is surely a consequence of declines in economic activity. Thus, it is almost certain that these estimates of the aftermath of crises are an upper bound of any genuine causal impact of distress on economic activity.

In addition to investigating the typical behavior of real variables following financial crises, we can also examine the behavior of financial distress itself in the wake of a crisis. To do this, we run the same regression as in equation (1), but with our new measure of financial distress as the dependent variable. Since by construction the response of distress to itself is one at $t = 0$, we only estimate horizons 1 to 10. This analysis shows that distress is highly serially correlated, particularly at near horizons.[18] This finding suggests that some of the near-term persistence we find in the negative aftermath of financial distress is likely due to persistence in distress itself. It is not necessarily that financial crises have long-lasting effects, but rather that crises themselves

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[18] Figure C3 of online Appendix C shows the estimated impulse response function.

tend to last for a while. This possibility, and the role that differences in the persistence of crises across episodes play in explaining the variation in output behavior, is analyzed further in Section III.

C. **Comparison with Results Using Alternative Chronologies**

Given that our new series on financial distress differs in important ways from existing crisis chronologies, it is useful to compare our findings for the average aftermath of financial crises with those estimated using the other series. As in Section I, we consider both the Reinhart and Rogoff and IMF crisis chronologies. We again only consider the alternative chronologies for the 24 advanced countries in our sample for the postwar period.[19] To incorporate the alternative chronologies into the empirical framework used above, we simply convert each to a dummy variable equal to 1 in the half-year in which a crisis began in a given country, and 0 otherwise. This allows us to create a panel dataset similar to that created using our new continuous measure of financial distress.

We estimate equation (1) for horizons 0 to 10 using each of the alternative crisis series in place of our financial distress variable (the F terms).[20] For simplicity, we only consider the results for real GDP. The resulting impulse response functions show the response of GDP to a realization of a 1 in the alternative chronology. Since the impulse response functions we show for our new series are for a realization of 7 on our scale from 0 to 15 (a moderate crisis–minus), the experiments considered are roughly comparable.

The impulse response functions for real GDP for both alternative crisis measures are shown in Figure 5, along with the baseline results using our new measure of financial distress (from panel (a) of Figure 4). The most obvious result from Figure 5 is that the basic pattern of

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[19] To make the three series as comparable as possible, we only include the systemic crises in the Reinhart and Rogoff chronology. Reinhart and Rogoff do not include Luxembourg in their analysis, and so have dates for only 23 of the countries.

[20] Though it is available for a longer period, we only consider the Reinhart and Rogoff series for the sample period for which our new measure exists (1967:1–2012:2). The IMF series is only available for a slightly shorter period (1970:1–2011:2).

the aftermath of financial crises is quite similar using all three crisis indicators. In each case, the average decline in real GDP following a financial crisis is negative, statistically significant, and quite persistent. The negative response is somewhat faster when the new measure of financial distress is used, particularly relative to when the Reinhart and Rogoff crisis dates are used. This is perhaps not surprising: the comparison of our measure of distress and the Reinhart and Rogoff crisis dates in Figures 2 and 3 shows that Reinhart and Rogoff often date crises decidedly earlier than our new measure does.

The other feature apparent in Figure 5 is that the average decline in real GDP in advanced economies following a financial crisis differs somewhat across the three crisis indicators, with the largest decline being when our new measure is used. Using our measure, the maximum decline in GDP following a financial crisis is 6.0 percent ($t = -5.3$); using the Reinhart and Rogoff systemic crisis dates, the maximum decline is 5.6 percent ($t = -3.8$); and using the IMF dates, the maximum decline is 3.8 percent ($t = -2.8$).[21]

The finding that the average aftermath of financial crises is reasonably moderate using both of the alternative crisis indicators may seem surprising given the findings of the previous literature. It reflects two important features of our analysis. One is the fact that we only consider crises in advanced economies in the post-1967 period. Many of the most extreme declines in GDP following financial crises occurred in emerging economies or in advanced economies before World War II. The second is that we use a regression-based empirical approach, rather than simpler methods like the average peak-to-trough decline in GDP around crises. The simpler approach may tend to attribute to a crisis falls in GDP that predate financial troubles, and so exaggerate the negative aftermath of crises.

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[21] In converting the Reinhart and Rogoff and the IMF crisis dates into dummy variables, we set the dummy equal to 1 in the half-year during which the chronology indicates that a country entered a crisis. An alternative is to set it equal to 1 in all half-years between (and including) the start and end dates of crises. When we use this alternative in the estimation, the aftermath of crises is virtually identical to those shown for the Reinhart and Rogoff and IMF chronologies in Figure 5. Figure C4 of online Appendix C shows the results of this alternative specification.

D. **Alternative Econometric Specifications**

We consider two econometric issues related to the estimation of the typical aftermath of a financial crisis.

Dealing with Heteroskedasticity. The first issue is possible differences in the variance of the residuals across countries. Economic activity is typically much more volatile in the less developed countries in our sample (such as Greece and Turkey), and in the smaller countries (such as Luxembourg, Iceland, and New Zealand). It is plausible to think that the variances of the residuals in equation (1) also vary systematically by country.

To take this into account, we estimate equation (1) using feasible two-step generalized least squares (GLS). Specifically, at each horizon, we find the variance of the residuals for each country from the OLS estimates of (1), and then perform weighted least squares using the inverse of the variances as the weights. The resulting impulse response functions for each of the three outcome measures are shown in Figure 6.

Taking into account heteroskedasticity in the residuals has a substantial impact on the estimates. Panel (a) shows the GLS impulse response function for GDP. Though the time pattern of the decline in GDP is relatively unchanged, the maximum impact is reduced by about one-third. Following an impulse in our new measure of distress of 7, real GDP declines 4.1 percent ($t = -4.7$) after 3½ years. Using GLS has a similar moderating impact on the impulse response function for the unemployment rate (panel c). Following an impulse to distress, the unemployment rate rises by a maximum of 1.6 percentage point ($t = 4.6$).

Interestingly, for industrial production (panel b), using GLS increases the maximum decline following an impulse to distress substantially, to 4.3 percent ($t = -2.9$). Industrial production is particularly volatile for a number of small countries in our sample, such as Iceland. Taking the heteroskedasticity of the residuals by country into account downweights some of the extreme observations. As a result, using GLS results in estimates for the behavior of GDP and industrial production following a financial crisis that are more in line with each

other—though the decline in industrial production is still somewhat smaller than might be expected given its usual greater cyclical sensitivity.

Overall, these results further confirm that the negative aftermath of financial crises is only moderate. The more severe effects shown by OLS are likely due to putting inappropriately large weight on the more volatile OECD countries.[22]

Alternative Treatment of the Contemporaneous Correlation. The second econometric issue we address concerns the treatment of the contemporaneous relationship between economic activity and financial distress. In our baseline specification, we follow the existing literature and include the contemporaneous correlation between the two series in the estimate of the typical aftermath of a financial crisis. An obvious alternative is to exclude the contemporaneous correlation between the two series in the estimate of the aftermath. (In conventional causal terminology, this corresponds to assuming that financial distress may be affected by economic activity contemporaneously, but economic activity is not affected by distress within the period.)

To implement this alternative assumption, we estimate:

$$(2) \qquad y_{j,t+i} = \alpha_j^i + \gamma_t^i + \beta^i F_{j,t} + \sum_{k=1}^3 \varphi_k^i F_{j,t-k} + \sum_{k=0}^3 \theta_k^i y_{j,t-k} + e_{j,t}^i,$$

for horizons 1 through 10. All variables are defined as before. By construction, the contemporaneous response of the outcome variable is zero. And, because $y_{j,t}$ is included in the estimation, the sequence of β^i's for horizons *t+1* to *t+10* will not include any of the contemporaneous relationship between economic activity and financial distress.

Figure 7 shows the implications of this alternative assumption for the impulse response

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[22] In a related exercise, we also consider alternative to conventional standard errors. In addition to heteroskedasticity of the residuals, there may also be serial correlation due to the overlapping structure of the residuals. We therefore experiment with both heteroskedasticity-consistent standard errors, and two forms of heteroskedasticity- and serial-correlation-corrected standard errors. Table C1 of online Appendix C shows that the alternative standard errors are typically about 30 to 50 percent larger than conventional standard errors. Thus, using the alternatives reduces the statistical significance of the estimated negative aftermath of a financial crisis substantially. Nonetheless, the estimates for GDP remain statistically significant at standard levels at all horizons.

function for real GDP. Panel (a) repeats the results of the baseline specification (any contemporaneous correlation between GDP and financial distress is included in the estimated aftermath of a financial crisis). Panel (b) shows the impulse response function under the alternative specification that any contemporaneous correlation between the two series is not included in the estimated aftermath. The impulse response function is decidedly less negative than that in the baseline specification. The alternative treatment of the contemporaneous correlation reduces the estimated maximum fall in real GDP following a financial crisis to 3.5 percent ($t = -3.4$) from the baseline estimate of 6.0 ($t = -5.3$).[23]

We also consider a variation on the treatment of the contemporaneous correlation that not only returns to the baseline specification that includes the contemporaneous correlation as part of the aftermath, but goes a step further. Our examination of additional real-time narrative sources in Section I.E finds that the *OECD Economic Outlook* was sometimes somewhat slower than the other sources in identifying financial distress. Thus, it is possible that even the behavior of economic activity a half-year before financial distress as reported in the *Economic Outlook* should be counted as part of the aftermath of a financial crisis. (In conventional causal terminology, this corresponds to assuming that distress in *t+1* is not affected by economic activity contemporaneously, but economic activity in *t* may be affected by distress in *t+1*.)

To allow for this possibility, we estimate equation (1) replacing $F_{j,t}$ with $F_{j,t+1}$ (and controlling for $F_{j,t-k}$ for $k = 0$ to 3) for horizons 0 to 10. With this specification, the impulse response function shows economic activity starting in period *t* following an impulse to distress in *t*+1. Since the evidence discussed in Section I.E suggests that the average delay in describing

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[23] The impact of the alternative treatment of the contemporaneous correlation is similar when unemployment is used as the outcome measure. For example, the maximum increase in unemployment following a financial crisis falls from 2.1 percentage points (t = 5.1) in the baseline specification to 1.4 percentage points (t = 3.3) in the alternative. For industrial production, the alternative treatment of the contemporaneous correlation has an even more dramatic impact. The response to a crisis is now never statistically significant, and the point estimate is positive at most horizons. Indeed, the maximum decline in industrial production is just 0.6 percent (t = −0.4). Figure C5 of online Appendix C shows the impulse response functions for industrial production and unemployment in the specification where none of the contemporaneous correlation with distress is included in the estimated aftermath.

distress in the *Economic Outlook* is considerably less than a full half-year, this alternative specification almost certainly overstates the effects of any lag in the OECD's assessments.

Panel (c) of Figure 7 shows that the estimated response of real GDP in *t* to an impulse in distress in *t*+1 (that is, at horizon 0) is small and insignificant. After horizon 0, the impulse response function is very similar to that in our baseline specification, but with a one-period delay.

Overall, this analysis of alternative treatments of the contemporaneous correlation between economic activity and financial distress again suggests that the baseline results are likely to be a rough upper bound of the negative aftermath of financial crises. Even the extreme assumption that the behavior of economic activity a half-year before the OECD identifies financial distress is part of the aftermath of a crisis does not result in noticeably larger estimated responses. And, assuming that none of the contemporaneous correlation is part of the aftermath of a crisis greatly reduces the estimated response.

III. VARIATION IN THE AFTERMATH OF FINANCIAL CRISES

So far, following most previous work, we have focused on what happens on average after a financial crisis. But variation is also important. A finding that the aftermath of a crisis is almost always grim—as maintained in some popular discussions—would make the prevention of crises critical, and would suggest questions about the reasons for the commonality. A finding of large heterogeneity in the aftermath of crises, on the other hand, might mean that responding to crises is as important as preventing them, and would raise the issue of the sources of the heterogeneity. In this section we analyze both the extent of heterogeneity and some possible explanations. For simplicity, we focus only on the results concerning the behavior of real GDP.

A. Outliers and Sensitivity to the Sample

Partial Association Scatter Plots. We begin by examining variation across our entire sample. Figure 8 shows the partial association scatter plot between GDP and financial distress

for our basic specification (equation 1) at three horizons: the contemporaneous period (panel a), after 2½ years (panel b), and after 5 years (panel c). In each panel, we label some of the noteworthy observations.

As one would expect given the strong statistical significance of our results, all three panels show a clear negative relationship between output and financial distress. At the same time, in each case there are some extreme observations. For example, in the contemporaneous relationship, Turkey in 2001:1 is an obvious outlier. At both the 2½- and 5-year horizons, the most extreme observations are from Greece in the post-2007 period. At these later horizons, many other important observations come from Japan. Because so many of the outliers at the 2½- and 5-year horizons correspond to Greece and Japan, we highlight the observations from these two countries in panels (b) and (c). Similarly, in all three panels there are some observations that depart sharply from the overall negative relationship. For example, Norway performed reasonably well at all horizons following its sharp rise in distress in 1991:2.

Another notable feature of the figure is that, with the exception of the observations from Japan, all of the most extreme observations come from smaller or less advanced economies. For example, the other six G7 countries do not contribute extreme observations in any of the panels.

To explore the importance of outliers more fully, we consider the sensitivity of the results to different sample restrictions.

Splitting the Sample in 2007:1. In our baseline results, we consider the full sample period for which we have data. But, Figure 8 shows that a disproportionate number of the extreme observations correspond to the 2008 global financial crisis, and this period seems potentially different in character from the rest of the sample. Thus, it is sensible to see how the estimated aftermath of crises varies before and after 2007. To do this, we simply split the sample into two periods: 1967:1–2006:2 and 2007:1–2012:2.

Figure 9 shows the results for the baseline full sample and the two subsamples. The typical aftermath of a crisis in the pre-2007 period is decidedly smaller than that for the full sample.

The maximum decline in GDP following a financial crisis in the pre-2007 period is 3.8 percent (t = −2.4), as opposed to 6.0 percent (t = −5.3) in the full sample.

Interestingly, the maximum decline following a crisis is also smaller in the 2007-and-after sample than in the full sample, though only slightly so. The maximum fall in GDP following a financial crisis in the post-2007 period is 4.7 percent (t = −5.4). The mechanical explanation for why the estimated responses are smaller in both subsamples is that splitting the sample introduces country fixed effects for each period. For example, the estimated fixed effects for Greece at long horizons for the post-2007 sample are far smaller than those for other countries, but this pattern does not hold in the pre-2007 sample. The economic interpretation is that the split sample allows for the possibility that factors other than changes in average financial distress in a country help explain changes in its average growth between the two periods.[24]

That the estimated response of GDP to financial distress is somewhat higher in the post-2007 sample likely cannot be explained by the greater correlation of distress across countries during the global financial crisis. Such spillovers or contagion effects would primarily show up in the time fixed effects. Because distress was on average quite high after 2007, the difference could reflect nonlinearities in the aftermath of distress. However, as we discuss in Section III.D, we find little evidence of such nonlinearities. Rather, we suspect that the somewhat greater estimated sensitivity in the post-2007 sample reflects either random variation due to the short sample, or some type of omitted variable bias. For example, it possible that the factors leading to the distress after 2007 in some countries—the housing boom and bust, a large expansion of credit, and fiscal concerns—may have caused distress to have particularly negative consequences in some countries, in a way that is not fully captured by the time fixed effects.

Excluding Individual Countries. Because Figure 8 shows that certain countries

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[24] An alternative way to consider splitting the sample is to interact the coefficients on the F variables in equation (1) with an indicator variable for the 2007-and-after period. This alternative imposes the restriction that the coefficient estimates other than those on financial distress (including the country fixed effects) are the same across samples. When this alternative is used, the maximum fall in GDP is 3.8 percent (t = −2.2) in the pre-2007 sample and 8.1 percent (t = −5.2) in the post-2007 sample.

account for many outliers, we consider the results of excluding various countries. Table 2 reports the sensitivity of the results to different country samples. For each sample, we show the estimated response of output to an innovation of 7 in financial distress for horizons 0, 5, and 10 half-years, as well as the maximum decline (which usually occurs at horizon 7). Row 1 repeats our baseline results, and Row 2 repeats our GLS estimates that downweight observations from countries with more volatile output. The remaining lines of the table show the effects of excluding individual countries.

Line 3 shows that, consistent with what one would expect from Figure 8, dropping Turkey sharply reduces the estimated response to distress in the near term but has smaller effects at longer horizons. Conversely, the next two lines show that dropping either Greece or Japan has almost no impact on the contemporaneous response, but reduces the response at longer horizons substantially. In all of the samples, however, the estimated relationship remains substantial and statistically significant.

It is more difficult to find variants that raise the estimated responses to distress. The largest effect comes from dropping Norway, which performed very well after its financial crisis of the early 1990s and fairly well after its sharp rise in distress in late 2008 and early 2009. However, as Line 6 of the table shows, the increase in the estimates from dropping Norway is generally smaller than the decrease from each of the other variants we consider.

This analysis provides further support to the conclusion of Section II that the results from our baseline specification and sample are high relative to other sensible ways of estimating the average aftermath of financial crises using our new measure. This reinforces the finding that the average aftermath is decidedly moderate. But the analysis also shows that the average masks a great deal of variation.

B. Looking in Depth at Heterogeneity in Key Episodes

The scatter plots show the variation across all observations at specific horizons. Another

way to investigate heterogeneity is to examine developments at all horizons following the times of greatest financial distress. In particular, there are 19 episodes in our sample when distress reached at least the lower end of the moderate crisis range—that is, at least 7.[25] Our interest is in the trajectory of output in the wake of these high levels of distress. Doing so allows us to see not just a snapshot of heterogeneity at a particular horizon, but heterogeneity in the full trajectory of output following significant crises.

To examine these episodes, we compare what happened to output following the crisis with what one would have predicted based only on the behavior of output before the crisis. A slight complication is that in many of the episodes, our measure shows noticeable financial distress one half-year before it reached 7. Since output in that half-year might have already reflected this distress, we ask what one would have predicted given the behavior of output through two half-years before our measure reached 7.

We construct the univariate forecasts by running the same type of regressions as before, but without the financial distress variable. That is, using our panel dataset for the 24 countries for the full sample period, we estimate:

(3)
$$y_{j,t+i} = \alpha_j^i + \gamma_t^i + \sum_{k=1}^{4} \theta_k^i \, y_{j,t-k} + e_{j,t}^i,$$

where y is the log of real GDP and the α's and γ's are again country and time fixed effects. As usual, we estimate (3) for various values of i. The equations show how, for our full sample of countries and years, output forecasts future output. To form the forecast for each episode, we take the relevant fitted values for the particular country and period from the sequence of regressions.[26]

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[25] We count a period where distress was 7 or more, then fell below 7 but remained elevated, and then returned to 7 or more as a single episode.

[26] For example, consider the moderate crisis–minus in the United States in 1990:2, for which we want to use GDP data through 1989:2. The forecast for 1990:1 is the fitted value from the regression for horizon 0 for the United States for t = 1990:1; the forecast for 1990:2 is the fitted value from the regression for horizon 1 for t = 1990:1; and so on.

Figure 10 shows the resulting forecast errors for the 19 episodes, where the forecast error is defined as actual log GDP minus predicted. It divides the episodes into three groups. Panel (a) shows the nine cases when the aftermath of a substantial crisis was benign or even slightly positive. Across these nine cases, the deviations from the pre-crisis prediction were largely symmetric around zero through a year after distress reached 7, and then were almost all positive.[27]

Panel (b) shows the four cases where the aftermath was mild to moderate. In these cases, output was typically several percent below the forecast path for the first two years after distress reached 7, but then recovered. After five years, output was actually above the forecast path in two of the four countries. And one of the episodes—Turkey in 2001:1—exhibits an extreme version of this pattern: output fell 12 percent below the forecast path a half-year after the crisis, but then recovered to 9 percent above after five years.

Finally, panel (c) shows the six cases of dismal aftermaths. These are Japan in 1997:2, Iceland in 2008:1, Italy, Portugal, and Spain in 2008:2, and Greece in 2009:1. The typical pattern in these cases was for output to hold up reasonably well for a few periods after the onset of considerable distress, but to then perform abysmally. The exception is Japan, where the poor performance started immediately. The maximum shortfall of output from the pre-crisis path was 29 percent in Greece, 17 percent in Japan, and between 8 and 10 percent in the other cases.

Thus, our evidence is not at all consistent with the often-expressed view that the aftermaths of financial crises are uniformly bad. Instead, the overwhelming message of this analysis is one of tremendous variation. Rather than showing that that the aftermath of a financial crisis is always dire, our evidence suggests that more often than not the aftermath is

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[27] In the episodes from the 2008 global financial crisis, the benign performance relative to the forecast path reflects a forecast of anemic growth and a path of actual output that was slightly stronger than the forecast. In turn, the anemic forecasts are the result of our inclusion of time fixed effects in equation (3): because growth was low in almost all countries following the global financial crisis, the forecasting equation predicts low overall growth in this period. If we do not include the fixed effects in (3), the aftermaths of the episodes of high distress in 2008 and 2009 appear much more severe.

mild, but sometimes it is horrific.[28]

C. <u>**The Role of Variation in the Behavior of Financial Distress**</u>

Having identified large variation in the aftermath of crises, the obvious question is what accounts for it. If one takes a more causal interpretation of the relationship between financial distress and various outcomes, a natural place to look for an explanation of the variation in the aftermaths of crises is in the behavior of financial distress itself. Perhaps worse outcomes are the result of more severe or persistent financial distress. Because our new measure is scaled, and so shows the level and evolution of distress in various episodes, we can analyze this issue.

To do so, we modify the forecasting exercise in Section III.B to incorporate the actual behavior of distress over the full episode. Specifically, we estimate:

(4) $$y_{j,t+i} = \alpha_j^i + \gamma_t^i + \sum_{k=-4}^{i} \varphi_k^i F_{j,t+k} + \sum_{k=1}^{4} \theta_k^i y_{j,t-k} + e_{j,t}^i.$$

Because the financial distress variable now has the same horizon as the output variable, we are using the entire evolution of distress in the forecast. That is, we are using the values of distress from $t - 4$ to $t + i$ to predict output in period $t + i$, and so we are incorporating the severity and persistence of distress. As before, we estimate the regression for various values of i. To form the forecasts for each episode, we take the relevant fitted values from the sequence of regressions. As in Section III.B, we start the forecasts one period before our measure reached 7; thus the forecasts again only use output data up through a year before distress reached 7.

Figure 11 displays the results for selected episodes where distress reached at least 7. Each panel plots two series. The first (in blue) is the forecast error from the forecast based only on output; these are the same as the series shown in Figure 10. The second (in red) is the forecast

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[28] Note that Figure 8 displays a similar pattern. The average relationship between the distress residuals and the output residuals is negative. But among the observations where the distress residuals are largest, there are cases where the output residuals are opposite-signed from the usual relationship or quite small. What drives the overall negative relationship is a subset of observations where large positive distress residuals are accompanied by large negative output residuals (or large negative distress residuals are accompanied by large positive output residuals).

error from the forecast that also accounts for the behavior of distress. Figure C6 of online Appendix C presents the results for the remaining episodes.[29]

This analysis shows that variation in the size and persistence of distress accounts for much of the variation in aftermaths. Most notably, in the six cases of extremely adverse aftermaths, including the actual behavior of distress accounts for a large part of the shortfall of output from the forecast based solely on output. In the cases of Spain in 2008:2 (panel e) and Italy and Portugal at the same time (shown in online Appendix C), including the actual behavior of distress explains essentially all of the poor post-crisis outcome. In the cases of Greece in 2009:1 (panel c), Japan in 1997:2 (panel d), and Iceland in 2008:1 (shown in online Appendix C), the behavior of distress accounts for about half of the shortfall of output from the forecast based only on output.

In the other cases, in contrast, including the actual behavior of distress has a much smaller impact on the forecasts. In the cases of Finland in 1993:1 (panel a), Turkey in 2001:1 (panel f), and Ireland in 2009:1 and Sweden in 1993:1 (shown in online Appendix C), including the path of distress improves the forecasts moderately. In three cases of relatively benign outcomes—Norway in 1991:2, the United Kingdom in 2008:1, and the United States in 2007:2 (all shown in online Appendix C)—including the actual path of distress actually makes the forecasts somewhat worse. And in the remaining cases, such as France in 2008:2 (panel b), there is no notable impact on the forecasts in either direction.

Once one recalls the behavior of financial distress in the various episodes, this pattern is not surprising. In all six cases with large shortfalls of output from the simple forecast, distress remained elevated for a prolonged period after hitting 7 or above. And in two cases, the peak level of distress was in the extreme crisis range. In the 13 cases without large shortfalls, on the other hand, distress almost always returned to low levels quickly, and in only two of them did it

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[29] Because our financial distress series ends in 2012:2, the forecasts incorporating the actual behavior of distress end before horizon 10 for the episodes where distress first reached 7 in 2008:1 or later. Also, note that the vertical axis encompasses a wider range of values in the panels for Turkey, Japan, and Greece than in the other panels.

make it into the major or extreme crisis range.

Thus, the actual behavior of distress accounts for an important part of the variation in post-crisis outcomes. At horizons up to a year, incorporating the actual behavior of distress into the forecast lowers the variance of the forecast error across the 19 cases by about 25 percent. At longer horizons, the proportion that is accounted for increases gradually. By 3½ years after distress reached 7 (the longest horizon for which we can do the calculation for the full sample), the fraction is over 50 percent. And at horizons of 4 to 5 years (where the sample size is smaller), the fraction is even greater.

D. **The Role of Nonlinearities**

The forecasting exercise suggests that differences in the severity and persistence of distress can explain some, but certainly not all, of the variation the aftermath of financial distress across episodes. Another, closely related, possibility is that the level of distress might explain more of the variation we observe if we took into account potential nonlinearities.

In constructing our measure of distress, we attempted to choose the gradations so that each step (such as credit disruption–regular to credit disruption–plus, or credit disruption–plus to minor crisis–minus) is of roughly equal significance. However, since the descriptions in the *OECD Economic Outlook* are qualitative rather than quantitative, we may not have been completely successful in this effort. Moreover, even if each step is equally important in its implications for the cost of credit intermediation, the behavior of the economy following an increase of a given size in the cost of intermediation may not be independent of the initial level of distress. If the relationship between our measure and subsequent outcomes is nonlinear for either reason, imposing linearity will lead to an understatement of the explanatory power of distress.

To investigate this possibility, we estimate variants of our baseline specification that relax the assumption that the aftermath of distress is linear in our measure, *F*. Specifically, we

estimate systems of equations of the form:

(5) $$y_{j,t+i} = \alpha_j^i + \gamma_t^i + \beta^i f(F_{j,t}) + \sum_{k=1}^{4} \varphi_k^i f(F_{j,t-k}) + \sum_{k=1}^{4} \theta_k^i y_{j,t-k} + e_{j,t}^i.$$

In our baseline specification, *f(F)* is simply *F* itself. Letting *f(F)* take other forms allows for nonlinearity. One obvious possibility is quadratic, so that $f(F) = F + bF^2$. With this specification, $b > 0$ corresponds to the case where the gaps between successive steps of our distress measure increase as one moves up the scale, or where the impact on the aftermath of equal increases in distress rise as distress rises. $b < 0$ corresponds to the opposite case. We also consider a generalization of the quadratic specification that includes additional knot points between credit disruptions and minor crises and between minor and moderate crises. That is, we parameterize *f(F)* as $F + b_0 F^2$ for $F \leq 3.5$; $F + b_0 F^2 + b_1(F - 3.5)^2$ for $3.5 \leq F \leq 6.5$; and $F + b_0 F^2 + b_1(F - 3.5)^2 + b_2(F - 6.5)^2$ for $F \geq 6.5$.[30]

The results suggest very little departure from linearity. In the quadratic case, the point estimate of *b* is 0.0017, with a standard error of 0.0183. Thus, the point estimate suggests an increasing marginal impact of another unit of distress at higher levels of distress; but the magnitude is extremely small, and the null hypothesis that the relationship is linear is not remotely close to rejection. With the spline specification, the parameter estimates are $b_0 = 0.10$ (standard error = 0.27), $b_1 = 0.07$ (0.28), and $b_2 = -0.38$ (0.28). Relative to the quadratic case, the estimates suggest somewhat more increasing marginal impact of distress into the moderate crisis range, but a decreasing marginal impact thereafter. However, the null of linearity is again not close to rejection: the *p*-value for the test of the joint hypothesis $b_0 = b_1 = b_2 = 0$ is 0.53.

Figure 12 summarizes the implications of the nonlinear specifications by showing the estimated responses of GDP to distress of 2 (a credit disruption–regular), 7 (a moderate crisis– minus), and 12 (a major crisis–plus) using the three specifications. The estimates for the

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[30] Attempting to include another knot point at $F = 9.5$ yields extremely imprecise estimates, presumably because of the small number of observations in the major and extreme crisis ranges.

baseline case of linearity are shown by the solid blue lines; those for the quadratic case are shown by the dotted red lines; and those for the spline are shown by the green lines. The estimates from the linear and quadratic specifications are visually indistinguishable for all three values of distress. With the spline specification, the estimated response to low distress is slightly weaker than in the baseline, and the response to moderate distress is slightly stronger. But the differences are small, and the estimated response to high distress is almost identical to the baseline. In short, we find no evidence of important nonlinearities.

IV. CONCLUSION

This paper provides new evidence on the aftermath of financial crises in advanced countries. We derive a new scaled indicator of financial distress for 24 OECD countries in the postwar period. Our measure, which is based on careful analysis of a single, real-time, narrative source, differs in important ways from existing crisis chronologies, and provides useful information on the severity and evolution of distress across episodes. An examination of three other real-time narrative sources for key episodes suggests that the new measure is reasonably accurate and reliable.

We use the new measure to examine the average aftermath of financial crises. Consistent with the previous literature, we find that GDP and industrial production fall rapidly and significantly following a crisis, and that unemployment rises. However, the magnitudes are moderate rather than terrible. Moreover, because we do not have enough information to isolate truly exogenous episodes of financial distress, our estimates of the typical aftermath are almost surely overestimates of any causal impact of crises. Sensible permutations of the econometric specification also suggest that our baseline results are at the upper end of plausible estimates of the average aftermaths.

We also examine the variation in the aftermath of crises. We find that particular observations are very influential in the estimation, and that alternative samples typically show

smaller average negative aftermaths. More fundamentally, the deviation of GDP from a pre-crisis univariate forecast differs dramatically across crisis episodes. Incorporating the actual behavior of our new scaled measure of financial distress into the forecasting exercise suggests that as much as half of the variation is attributable to variation in the level and persistence of distress across episodes. Interestingly, nonlinearities in the response of GDP to distress account for little of the variation in aftermaths.

These findings have implications both on their own and for future research. Our finding that we are able to derive a scaled measure of financial distress using a narrative source suggests a possible new role for narrative analysis. Most previous narrative work has sought mainly to identify key episodes. This study suggests that it may be possible to go further and use narrative sources to code more nuanced developments—not just in the case of financial distress, but in other applications as well.

Further research would be helpful in testing the validity of our new measure of financial distress. For example, while there are reasons to be skeptical of purely statistical indicators of distress, it would be good to evaluate systematically how our new measure correlates with such indicators as interest rate spreads when they are available. Future research might also apply this paper's approach to a broader range of countries. For example, the staff reports for the IMF Article IV consultations could perhaps be used to create a consistent scaled measure of financial distress for a mix of advanced and developing economies. Such new measures of financial distress, including the one presented in this paper, are likely to be a useful input to a broad range of future research studies.

Our finding that the average aftermath of financial crises in advanced countries is poor, but not terrible, suggests a slightly less dire twist on the conventional wisdom that the typical aftermath of a crisis is awful. Even so, it is clear that policymakers or forecasters faced with a crisis should be prepared for significant and persistent negative developments in the real economy.

In terms of further study in this along this dimension, by far the most valuable would be to establish how much of the average aftermath of financial crises represents a causal relationship. We are not optimistic that in the modern era, even the most diligent narrative work could identify a set of truly exogenous financial crises. In an environment of thick markets, we suspect that there are few episodes of significant widespread distress caused by idiosyncratic factors unrelated to economic activity. Instead, the most fruitful approach to establishing causation may lie in combining natural experiments with detailed cross-section evidence (as in Peek and Rosengren, 2000, Dell'Ariccia, Detragiache, and Rajan, 2008, and Chodorow-Reich, 2014).

Our finding that there is tremendous variation in the aftermath of financial crises may be the most important result of all. A financial crisis does not have to be a deathblow to an economy. While some countries have been truly devastated by a crisis, many others have done surprisingly well afterward. Our finding that the severity and persistence of the financial distress itself is important to the aftermath suggests that, rather than just focusing on preventing crises, policymakers also need to consider actions to prevent distress from reaching high levels and to resolve distress quickly. An obvious area of useful further research concerns just what those actions are and which would be most cost-effective.

While we account for some of the variation in the aftermath of crises with the severity and persistence of distress, a substantial fraction remains a mystery. One possibility is that other factors that often accompany financial crises play a role. For example, recent research suggests that high levels of indebtedness may have a direct negative impact on consumer spending and output (see, for example, Mian and Sufi, 2014). To the degree that such factors are imperfectly correlated with financial crises, they could explain some of the variation across episodes.

Another obvious possible explanation that deserves further study is the role that the policy response can play in counteracting the negative aftermath of a financial crisis. For example, it is possible that being at or hitting the zero lower bound on interest rates during a crisis makes the aftermath worse than in cases where monetary policy can be used to cushion the decline in

economic activity. We plan to investigate the role of both monetary and fiscal policy constraints in explaining the variation in the aftermath of crises in future work.

TABLE 1
Financial Distress in OECD Countries, 1967:1–2012:2

Australia	**France**	**Iceland** (continued)
2008:1 Credit disrupt.–reg.	1991:2 Credit disrupt.–minus	2007:2 Credit disrupt.–plus
2008:2 Minor crisis–minus	1995:1 Credit disrupt.–reg.	2008:1 Moderate crisis–reg.
2009:1 Credit disrupt.–minus	1995:2 Minor crisis–minus	2008:2 Major crisis–reg.
	1996:1 Minor crisis–reg.	2009:1 Extreme crisis–reg.
Austria	1996:2 Minor crisis–reg.	2009:2 Moderate crisis–plus
2008:2 Moderate crisis–minus	1997:1 Credit disrupt.–plus	2010:1 Moderate crisis–minus
2009:1 Moderate crisis–minus	2007:2 Credit disrupt.–plus	2010:2 Moderate crisis–minus
2009:2 Minor crisis–minus	2008:1 Credit disrupt.–reg.	2011:1 Moderate crisis–minus
2010:1 Minor crisis–minus	2008:2 Moderate crisis–minus	2011:2 Minor crisis–minus
2010:2 Credit disrupt.–minus	2009:1 Minor crisis–plus	2012:1 Credit disrupt.–reg.
2011:1 Credit disrupt.–minus	2009:2 Minor crisis–minus	
2011:2 Credit disrupt.–plus	2010:1 Credit disrupt.–plus	**Ireland**
2012:1 Minor crisis–reg.	2010:2 Credit disrupt.–minus	2007:2 Credit disrupt.–minus
2012:2 Credit disrupt.–plus	2011:1 Credit disrupt.–minus	2008:2 Minor crisis–plus
	2011:2 Minor crisis–reg.	2009:1 Moderate crisis–minus
Belgium	2012:1 Minor crisis–minus	2009:2 Minor crisis–plus
2008:2 Minor crisis–minus	2012:2 Credit disrupt.–minus	2010:1 Moderate crisis–reg.
2009:1 Credit disrupt.–plus		2010:2 Moderate crisis–minus
2009:2 Credit disrupt.–reg.	**Germany**	2011:1 Moderate crisis–reg.
2011:2 Credit disrupt.–reg.	1974:2 Credit disrupt.–reg.	2011:2 Minor crisis–plus
	2003:1 Credit disrupt.–minus	2012:1 Minor crisis–reg.
Canada	2007:2 Credit disrupt.–reg.	2012:2 Minor crisis–plus
2007:2 Credit disrupt.–plus	2008:1 Minor crisis–minus	
2008:1 Minor crisis–minus	2008:2 Minor crisis–plus	**Italy**
2008:2 Minor crisis–reg.	2009:1 Minor crisis–reg.	1997:1 Credit disrupt.–minus
2009:1 Minor crisis–reg.	2009:2 Minor crisis–minus	2007:2 Credit disrupt.–minus
2009:2 Credit disrupt.–plus	2010:1 Minor crisis–minus	2008:1 Minor crisis–minus
	2010:2 Credit disrupt.–reg.	2008:2 Moderate crisis–minus
Denmark	2011:1 Credit disrupt.–minus	2009:1 Minor crisis–plus
2008:1 Credit disrupt.–minus	2011:2 Credit disrupt.–plus	2009:2 Minor crisis–reg.
2008:2 Minor crisis–plus	2012:1 Credit disrupt.–reg.	2010:1 Minor crisis–plus
2009:1 Moderate crisis–minus	2012:2 Credit disrupt.–reg.	2010:2 Minor crisis–minus
2009:2 Minor crisis–plus		2011:1 Credit disrupt.–reg.
2010:1 Credit disrupt.–plus	**Greece**	2011:2 Minor crisis–reg.
2011:2 Credit disrupt.–plus	2008:2 Minor crisis–minus	2012:1 Moderate crisis–minus
2012:1 Credit disrupt.–reg.	2009:1 Moderate crisis–minus	2012:2 Moderate crisis–reg.
2012:2 Credit disrupt.–minus	2009:2 Minor crisis–plus	
	2010:1 Moderate crisis–reg.	**Japan**
Finland	2010:2 Moderate crisis–minus	1990:2 Credit disrupt.–plus
1992:1 Credit disrupt.–reg.	2011:1 Moderate crisis–minus	1991:1 Credit disrupt.–minus
1992:2 Minor crisis–plus	2011:2 Moderate crisis–minus	1991:2 Minor crisis–reg.
1993:1 Moderate crisis–reg.	2012:1 Moderate crisis–reg.	1992:1 Credit disrupt.–plus
1993:2 Minor crisis–reg.	2012:2 Moderate crisis–reg.	1992:2 Minor crisis–minus
1994:1 Credit disrupt.–plus		1993:1 Minor crisis–minus
2008:2 Minor crisis–minus	**Iceland**	1993:2 Minor crisis–reg.
2009:1 Minor crisis–minus	2006:2 Minor crisis–reg.	1994:1 Credit disrupt.–plus
2009:2 Credit disrupt.–minus	2007:1 Credit disrupt.–reg.	1994:2 Credit disrupt.–plus

Japan (continued)
1995:1 Minor crisis–minus
1995:2 Minor crisis–reg.
1996:1 Minor crisis–plus
1996:2 Minor crisis–minus
1997:1 Minor crisis–reg.
1997:2 Moderate crisis–minus
1998:1 Major crisis–reg.
1998:2 Extreme crisis–minus
1999:1 Moderate crisis–plus
1999:2 Minor crisis–plus
2000:1 Minor crisis–minus
2000:2 Credit disrupt.–plus
2001:1 Minor crisis–plus
2001:2 Minor crisis–plus
2002:1 Moderate crisis–reg.
2002:2 Moderate crisis–minus
2003:1 Minor crisis–plus
2003:2 Minor crisis–reg.
2004:1 Minor crisis–minus
2004:2 Credit disrupt.–plus
2005:1 Credit disrupt.–reg.
2008:2 Credit disrupt.–plus
2009:1 Minor crisis–minus
2009:2 Credit disrupt.–plus
2010:1 Credit disrupt.–minus

Luxembourg
2008:1 Credit disrupt.–reg.
2008:2 Minor crisis–reg.
2009:1 Credit disrupt.–plus
2009:2 Credit disrupt.–reg.
2010:1 Credit disrupt.–minus
2011:2 Credit disrupt.–reg.

Netherlands
2008:1 Credit disrupt.–minus
2008:2 Credit disrupt.–plus
2009:1 Minor crisis–minus
2009:2 Credit disrupt.–minus
2011:2 Credit disrupt.–minus
2012:1 Minor crisis–minus
2012:2 Credit disrupt.–reg.

New Zealand
2007:2 Credit disrupt.–reg.
2008:1 Credit disrupt.–plus
2008:2 Minor crisis–plus
2009:1 Minor crisis–plus
2009:2 Minor crisis–minus
2010:1 Credit disrupt.–minus

New Zealand (continued)
2010:2 Credit disrupt.–minus
2011:2 Credit disrupt.–plus
2012:1 Credit disrupt.–minus

Norway
1991:2 Moderate crisis–plus
1992:1 Minor crisis–reg.
1992:2 Moderate crisis–reg.
1993:1 Minor crisis–plus
1993:2 Credit disrupt.–plus
1994:1 Credit disrupt.–reg.
2007:2 Credit disrupt.–minus
2008:1 Minor crisis–minus
2008:2 Moderate crisis–minus
2009:1 Moderate crisis–plus
2009:2 Minor crisis–reg.

Portugal
2008:1 Minor crisis–plus
2008:2 Moderate crisis–minus
2009:1 Moderate crisis–reg.
2009:2 Minor crisis–reg.
2010:1 Minor crisis–plus
2010:2 Moderate crisis–plus
2011:1 Moderate crisis–reg.
2011:2 Moderate crisis–minus
2012:1 Moderate crisis–reg.
2012:2 Moderate crisis–reg.

Spain
2008:1 Minor crisis–plus
2008:2 Moderate crisis–minus
2009:1 Minor crisis–plus
2009:2 Credit disrupt.–plus
2010:1 Minor crisis–minus
2010:2 Minor crisis–reg.
2011:1 Minor crisis–minus
2011:2 Moderate crisis–minus
2012:1 Moderate crisis–minus
2012:2 Moderate crisis–reg.

Sweden
1992:2 Minor crisis–reg.
1993:1 Moderate crisis–reg.
2008:1 Minor crisis–minus
2008:2 Moderate crisis–minus
2009:1 Minor crisis–reg.
2009:2 Minor crisis–minus
2010:1 Credit disrupt.–plus
2010:2 Credit disrupt.–reg.

Switzerland
2007:2 Credit disrupt.–reg.
2008:1 Minor crisis–minus
2008:2 Credit disrupt.–plus
2009:1 Credit disrupt.–minus
2012:1 Credit disrupt.–minus

Turkey
2001:1 Moderate crisis–reg.
2001:2 Moderate crisis–reg.
2002:1 Minor crisis–plus
2002:2 Minor crisis–minus
2003:1 Minor crisis–minus
2003:2 Credit disrupt.–reg.
2008:2 Minor crisis–reg.
2009:1 Credit disrupt.–plus
2009:2 Credit disrupt.–minus

United Kingdom
2007:2 Minor crisis–plus
2008:1 Moderate crisis–minus
2008:2 Major crisis–minus
2009:1 Moderate crisis–plus
2009:2 Moderate crisis–minus
2010:1 Minor crisis–reg.
2010:2 Minor crisis–reg.
2011:1 Credit disrupt.–reg.
2011:2 Credit disrupt.–plus
2012:1 Credit disrupt.–reg.
2012:2 Credit disrupt.–plus

United States
1986:1 Credit disrupt.–minus
1990:1 Minor crisis–reg.
1990:2 Moderate crisis–minus
1991:1 Minor crisis–minus
1991:2 Credit disrupt.–plus
1992:1 Credit disrupt.–reg.
1998:2 Credit disrupt.–plus
2007:1 Credit disrupt.–minus
2007:2 Moderate crisis–minus
2008:1 Moderate crisis–plus
2008:2 Extreme crisis–reg.
2009:1 Major crisis–minus
2009:2 Moderate crisis–minus
2010:1 Minor crisis–plus
2010:2 Credit disrupt.–plus
2011:2 Credit disrupt.–reg.
2012:1 Credit disrupt.–minus
2012:2 Credit disrupt.–minus

Notes: Based on the *OECD Economic Outlook*. The sample period is 1967:1–2012:2 for all countries except Australia (1971:2–2012:2), Finland (1969:1–2012:2), and New Zealand (1973:1–2012:2). We only consider the 24 OECD member countries as of 1973.

TABLE 2
Response of Real GDP to Financial Distress for Different Specifications and Samples

	Specification	Horizon (Half-Years)			Maximum Response
		0	5	10	
(1)	Baseline	−2.08 (0.34)	−4.72 (0.92)	−4.61 (1.39)	−5.96 (1.11)
(2)	GLS	−1.24 (0.27)	−3.26 (0.74)	−2.25 (1.06)	−4.07 (0.87)
(3)	Excluding Turkey	−1.37 (0.32)	−4.11 (0.91)	−4.36 (1.41)	−5.48 (1.11)
(4)	Excluding Greece	−1.90 (0.32)	−3.57 (0.89)	−3.49 (1.32)	−4.83 (1.07)
(5)	Excluding Japan	−2.15 (0.36)	−4.55 (0.98)	−3.01 (1.47)	−5.47 (1.18)
(6)	Excluding Norway	−2.22 (0.36)	−5.36 (0.98)	−5.57 (1.50)	−6.76 (1.19)

Notes: The table reports the impulse response function for real GDP at selected horizons to an impulse of 7 in our new measure of financial distress for various specifications and samples. Standard errors are in parentheses.

EXHIBIT 1
Sample Descriptions of Episodes from Online Appendix A

A. Credit Disruption—Regular

Germany, 1974:2. The OECD reported that during the summer, "considerable losses of exchange reserves and the imminent danger of a confidence crisis imposed particular strains on the banking system," and that "[s]pecial credit facilities were extended to small and medium-sized companies and reserve requirements were reduced in September and October" (p. 26; see also p. 51). And in a discussion of Germany, the United Kingdom, and the United States, it stated, "Recent strains on the banking system in all three countries have underlined the unfavourable climate in bank lending markets. ... There is evidence in all three countries that smaller companies have been particularly severely rationed or priced out of bank lending markets" (p. 50). Notably, there was no mention of financial-market difficulties in the section that was specifically devoted to Germany. Given that omission, it is clear that the OECD did not view financial-market problems as being a major factor in the behavior of the German economy. On the other hand, it identified strains on the banking system, and Germany had perceived a need for special facilities to support lending to certain types of businesses.

This disruption seems similar to that in the United States in 1992:1 (which we classify as a regular credit disruption), and less serious than that in the United States in 1991:2 (which we classify as a credit disruption—plus). We code this episode as a credit disruption—regular.

B. Minor Crisis—Regular

France, 1996:1. The OECD reported (p. 78):

In 1995, the banking sector continued to suffer from low credit demand, high refinancing and operating costs and large provisions for bad debts. As a result, profitability has been very low by international comparison. The State has provided financial support to some banks and insurance companies, and several financial companies have created special corporate structures in order to assure that prudential ratios are higher than required. Lower short-term interest rates will reduce refinancing costs and help the financial sector to restore profitability. However, the current level of provisions still does not cover all doubtful credits as the real estate market has softened again and the restructuring of the banking sector is advancing only slowly.

The combination of the significant problems in the banking sector, the statement that banks faced high refinancing costs, and the fact that the banking problems were not given a central role in the OECD's discussion of the outlook causes us to identify this episode as a minor crisis—regular. This classification is consistent the fact that we classify France in 1995:2 as a minor crisis—minus, and that the description of the health of the banking sector in this issue is slightly more negative.

C. Moderate Crisis—Regular

Sweden, 1993:1. In the summary of its entry, the OECD said, "Steeply falling property values have led to a sharp increase in corporate bankruptcies and heavy loan losses in banks' balance sheets" (p. 113). A paragraph devoted to the financial system reported (p. 115):

Falling asset values and corporate bankruptcies linked to the collapse in the commercial property market have provoked an unprecedented increase in banks' loan losses. These reached Skr 70 billion in 1992 (7.7 per cent of outstanding loans), up from Skr 36 billion in 1991. Losses are widely expected to remain high in 1993. With the capital bases of most major

banks rapidly eroding, the Government has guaranteed that banks can meet their commitments. Government rescue operations are officially estimated to burden the 1992/93 budget by Skr 22 billion (1½ per cent of GDP), with off-budget loans and guarantees amounting to an additional Skr 46 billion (over 3 per cent of GDP). It is not known what scale of rescue operations will be needed in the 1993/94 budget.

Finally, in discussing risks to the outlook, the OECD stated, "greater weakness of demand could be accentuated by rising capital costs in the event of larger loan losses. This would ... risk reducing credit supply" (p. 115).

This episode is similar to Norway in 1992:2 and Finland in 1993:1. The most obvious difference is that in this case, the OECD devoted a sentence in its summary to the financial-market problems. But the financial system was starting from a slightly better position than Finland's was (as described above, we code Sweden in 1992:2 as a minor crisis–regular, whereas we classify Finland in 1992:2 as a minor crisis–plus). And, in contrast to the discussion of Norway, there was no explicit reference to firms facing difficulties in obtaining financing. We therefore also classify this episode as a moderate crisis–regular.


D. Extreme Crisis–Minus

Japan, 1998:2. As just discussed, we classify Japan in 1998:1 as a major crisis–regular. Here, the OECD described a situation that was notably worse. Among its stronger phrases were "financial paralysis" (p. 20); the "breakdown in the credit creation mechanism, and the resulting widening of creditor risk premia" (p. 44); "banks remain in dire straits as risk premia widen" (p. 45); "the increasingly serious situation in the banking sector" (p. 45); and "credit crunch" (which it used repeatedly). In addition, it discussed major government interventions in the financial system: "a broad agreement was achieved in the Diet to revitalise the financial system. The new legislation includes important measures to deal with financial sector problems. To support this, the Government has made an unprecedentedly large sum of public funds available to recapitalize the banking system, amounting overall to around ¥ 60 trillion, or about 12 per cent of GDP" (p. ix).

The OECD made it clear that those developments were having an important impact on the economy. For example, it said, "a profound lack of confidence, in large part due to the severe and prolonged crisis in the banking system, has depressed private spending" (p. 20); reported that "the balance sheet problems of the banking sector remain unresolved, and the resulting uncertainty has led to diminished confidence among consumers and investors, leading to sharp declines in private spending" (p. 42); and referred to "risks of a deflationary spiral arising in part from the unresolved problems in the banking sector" (p. 44).

However, although there had clearly been a nontrivial deterioration from 1998:1, the OECD did not describe the situation as qualitatively changed. For example, it said, "banking sector problems were not improving" (p. ix), and referred to "continued concerns about the health of the financial system" (p. 12). And in the summary of its entry, it stated, "The credit crunch is continuing" (p. 42). Also, as noted above, it commented that "banks remain in dire straits" (p. 45).

Thus, the financial-sector problems had become significantly but not dramatically worse. We therefore classify this episode as two steps more serious than in 1998:1, which corresponds to an extreme crisis–minus.

FIGURE 1
New Measure of Financial Distress for Advanced Countries
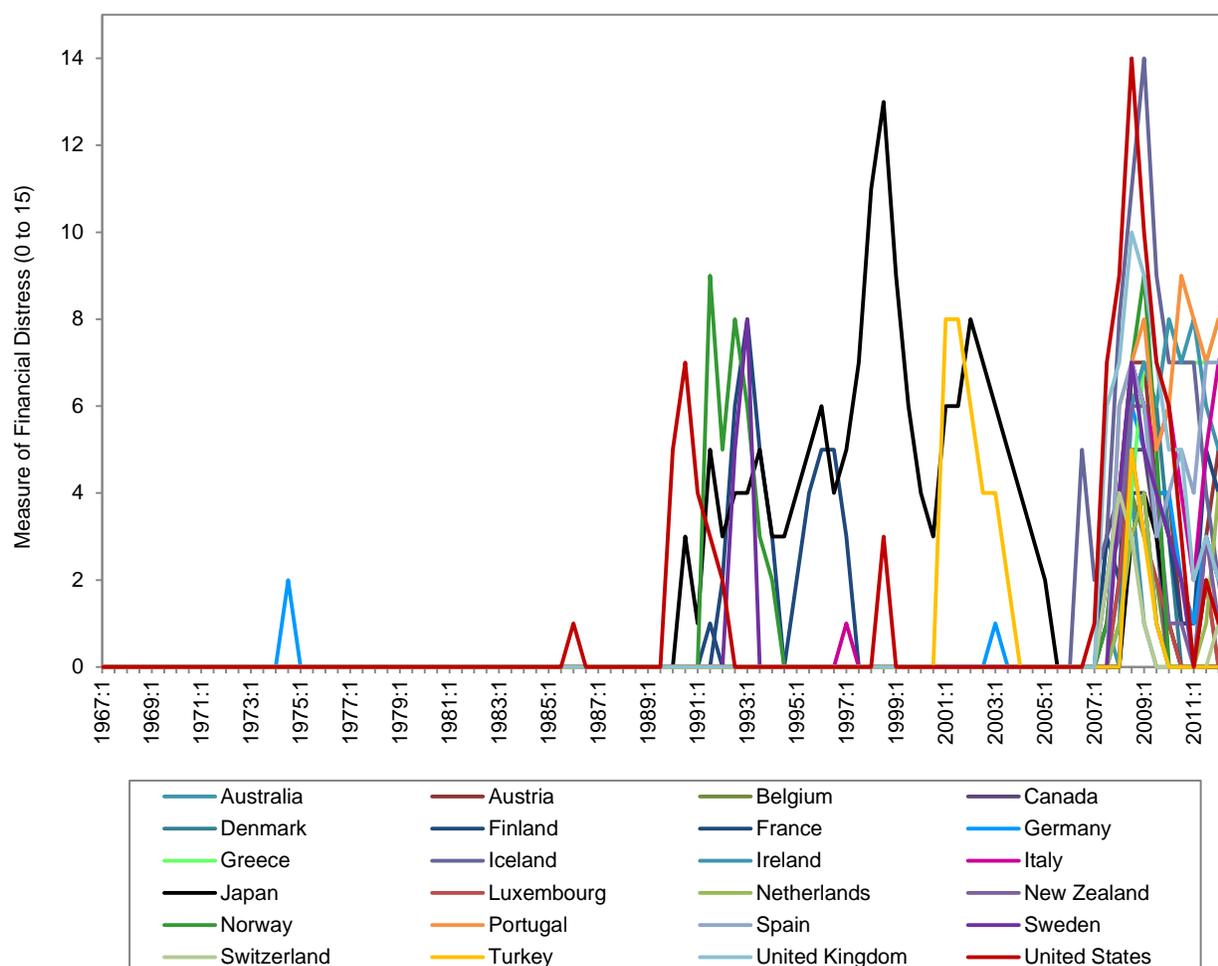
Notes: See text and online Appendix A for details about the derivation of the new measure. The data are available semiannually from 1967:1 to 2012:2. In the new measure, 0 corresponds to no financial distress; 1, 2, and 3 correspond to gradations of credit disruptions; 4, 5, and 6 to gradations of minor crises; 7, 8, and 9 to gradations of moderate crises; 10, 11, and 12 to gradations of major crises; and 13, 14, and 15 to gradations of extreme crises.

FIGURE 2
Comparison of the New Measure and Other Crisis Chronologies for Key Pre-2007 Episodes
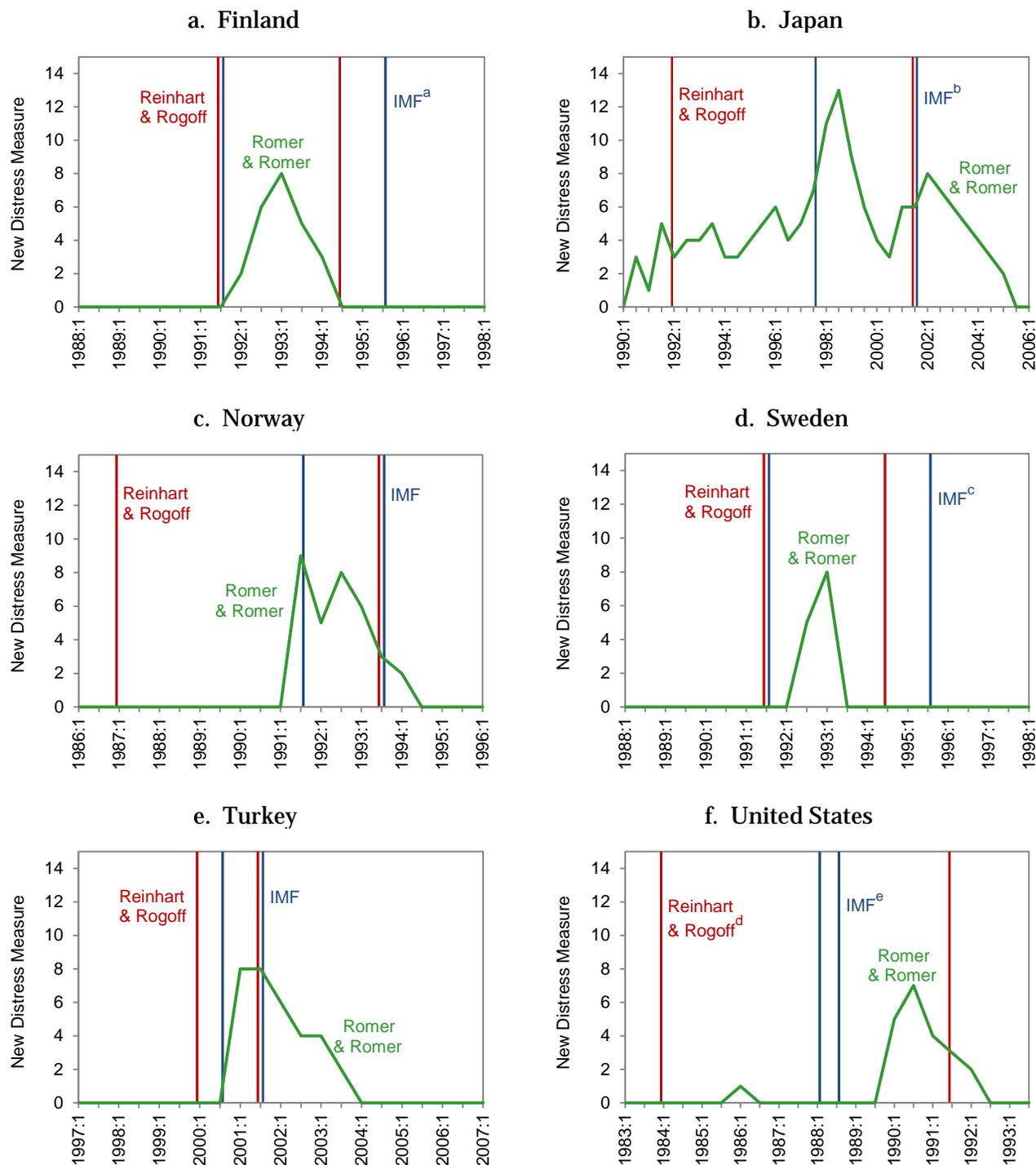

Notes: The vertical lines represent the start and end dates of financial crises in the Reinhart and Rogoff and IMF chronologies, converted to semiannual observations as described in the text. (a) not systemic until 1993:1; (b) end date determined by a rule that crises are truncated at five years; (c) not systemic until 1992:2; (d) not systemic; (e) borderline crisis.

FIGURE 3
Comparison of the New Measure and Other Crisis Chronologies for Selected Post-2007 Episodes
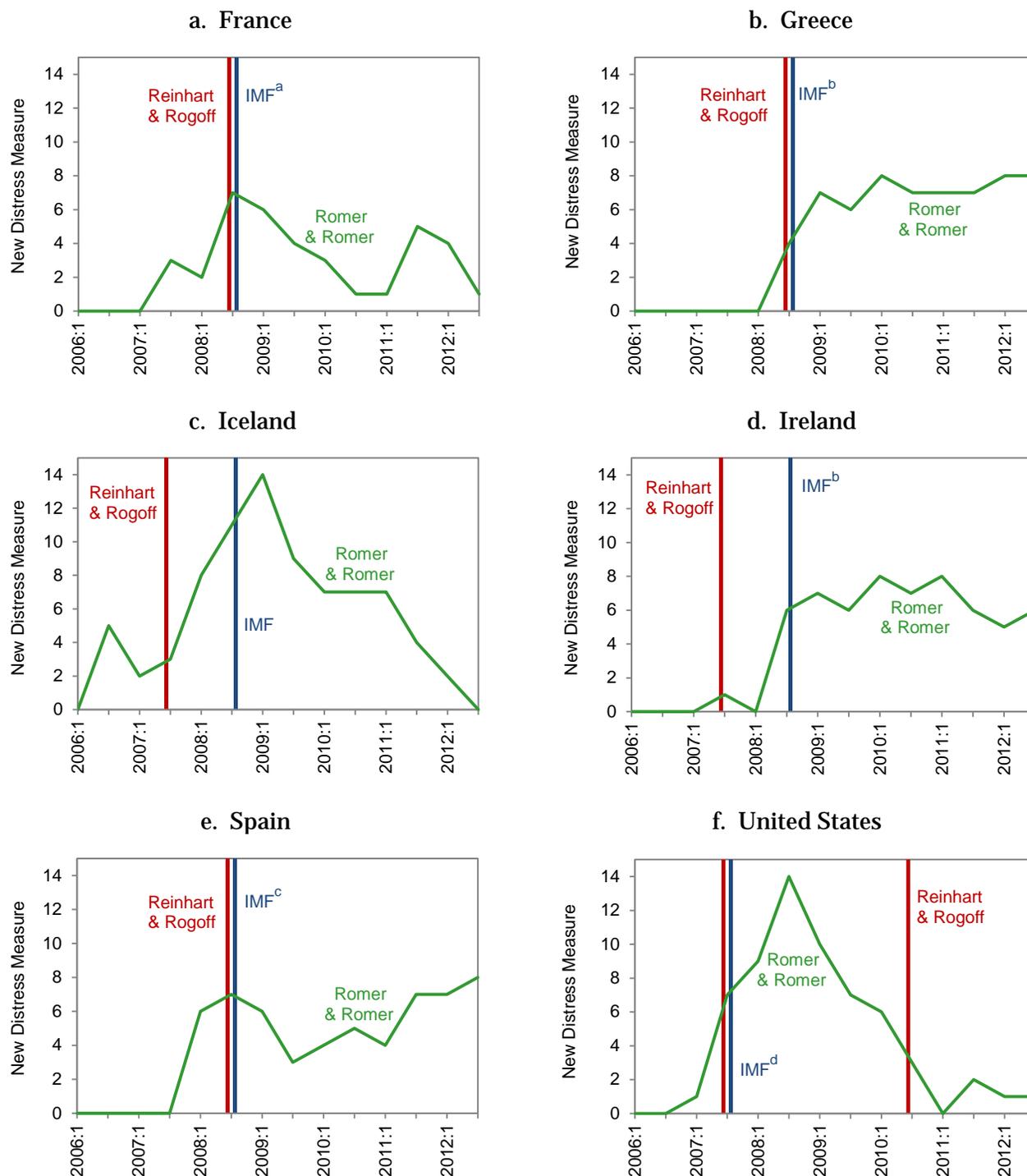
a. France

b. Greece

c. Iceland

d. Ireland

e. Spain

f. United States

Notes: The vertical lines represent the start and end dates of financial crises in the Reinhart and Rogoff and IMF chronologies, converted to semiannual observations as described in the text. The IMF series ends in 2011:2, so the lack of an end date does not necessarily indicate that IMF believed the crisis continued through 2012:2. (a) borderline crisis; (b) not systemic until 2009:1; (c) not systemic until 2011:1; (d) not systemic until 2008:2.

FIGURE 4
Response of Outcome Variables to Financial Distress, Full Sample, OLS
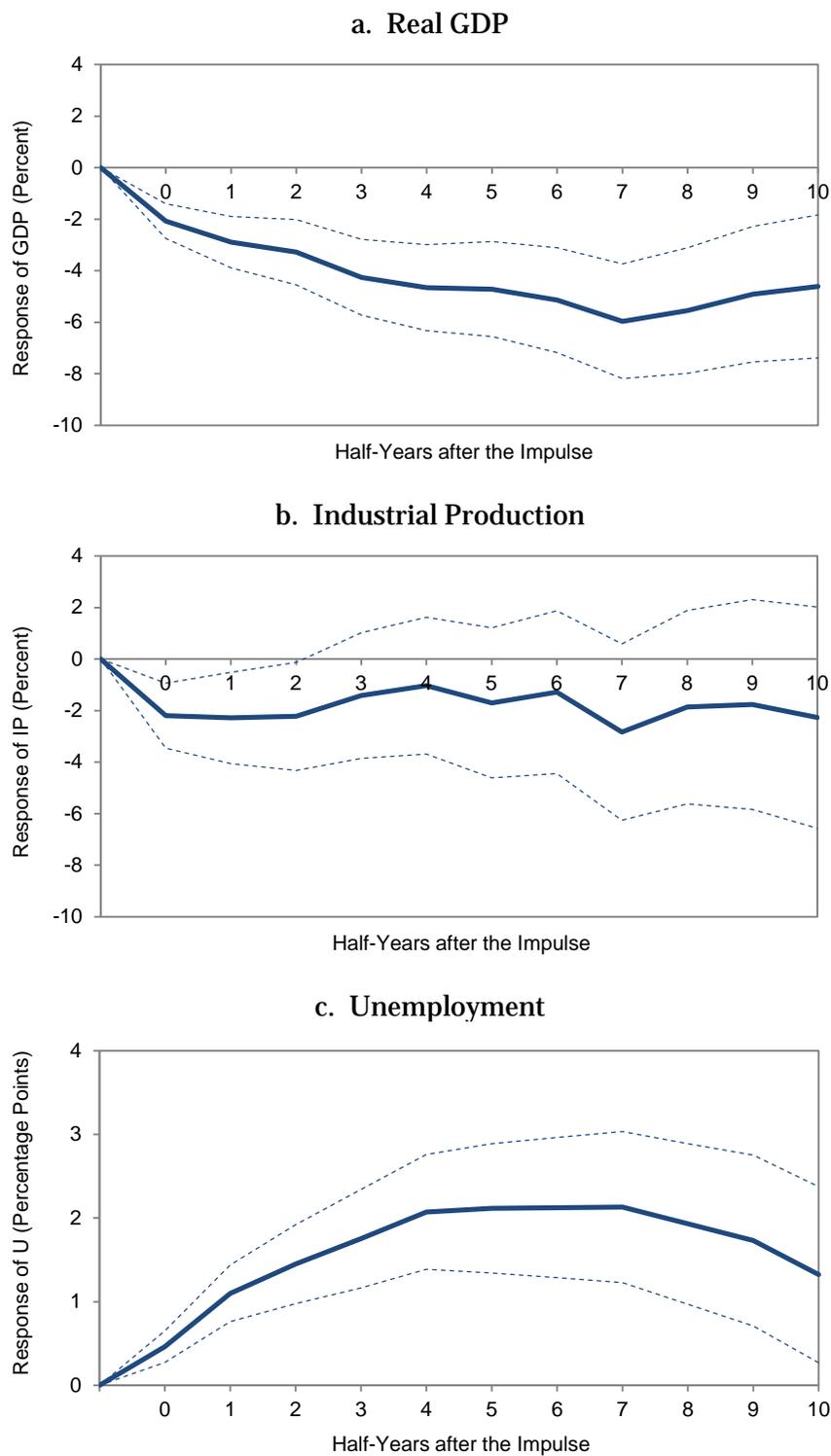
a. Real GDP
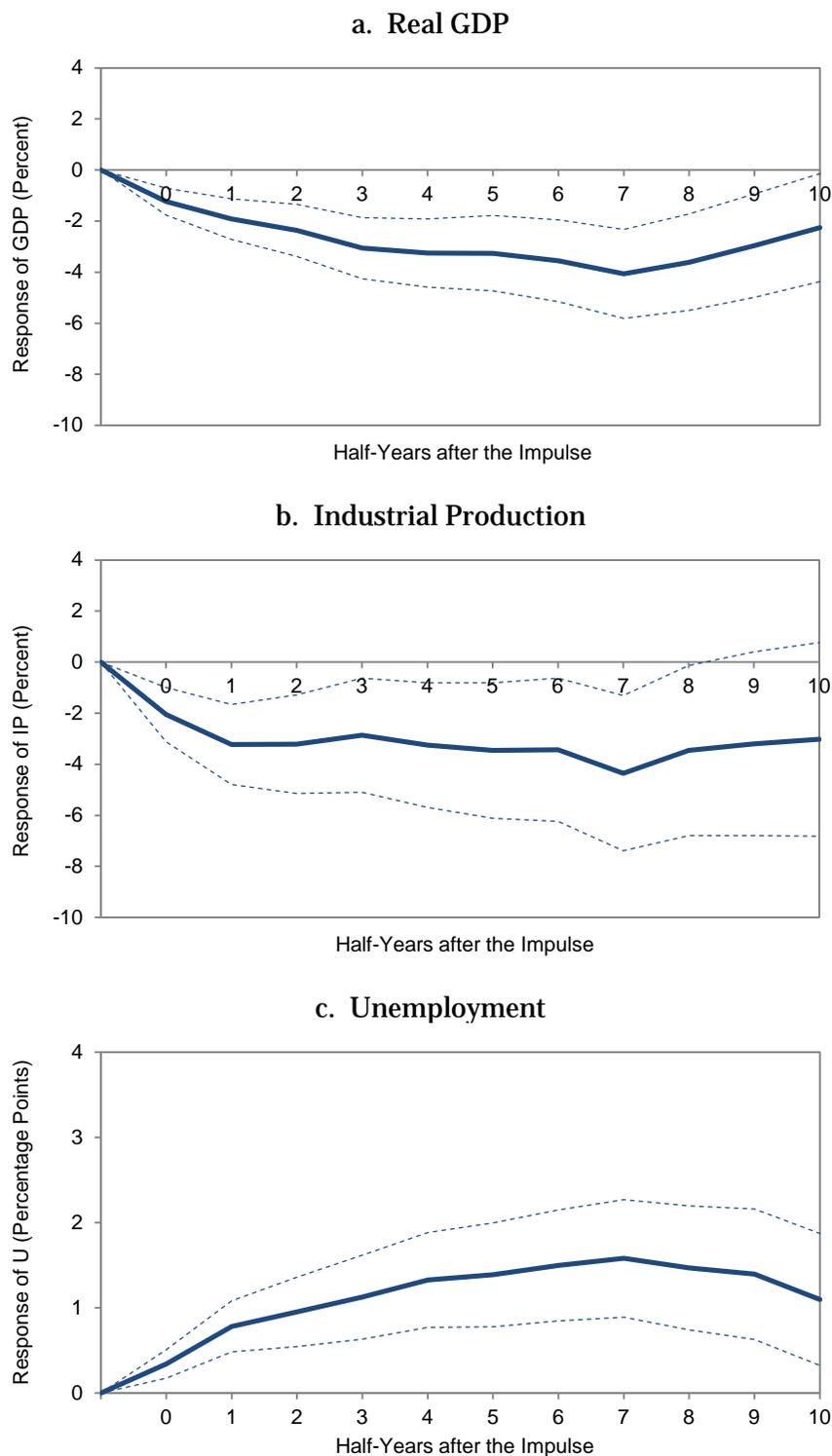

b. Industrial Production

c. Unemployment

Notes: The figures show the impulse response functions for various outcome variables to an impulse of 7 in our new measure of financial distress derived from estimating equation (1) for the sample of 24 OECD countries over the full sample period using OLS. The dashed lines show the two-standard-error confidence bands.

FIGURE 5
Response of Real GDP to Financial Distress, Alternative Crisis Chronologies

a. New Measure of Financial Distress

b. Reinhart and Rogoff Crisis Chronology
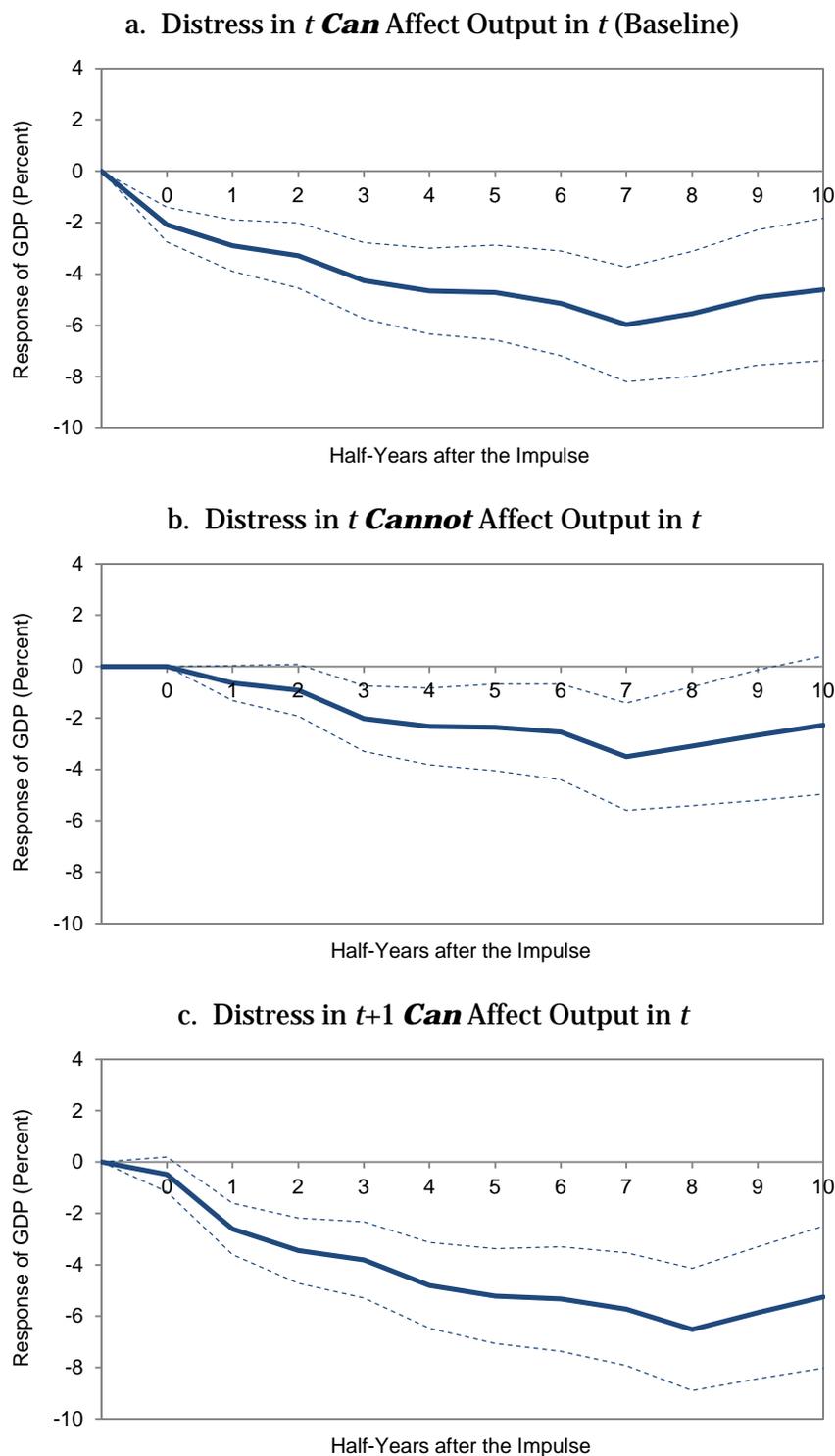

c. IMF Crisis Chronology
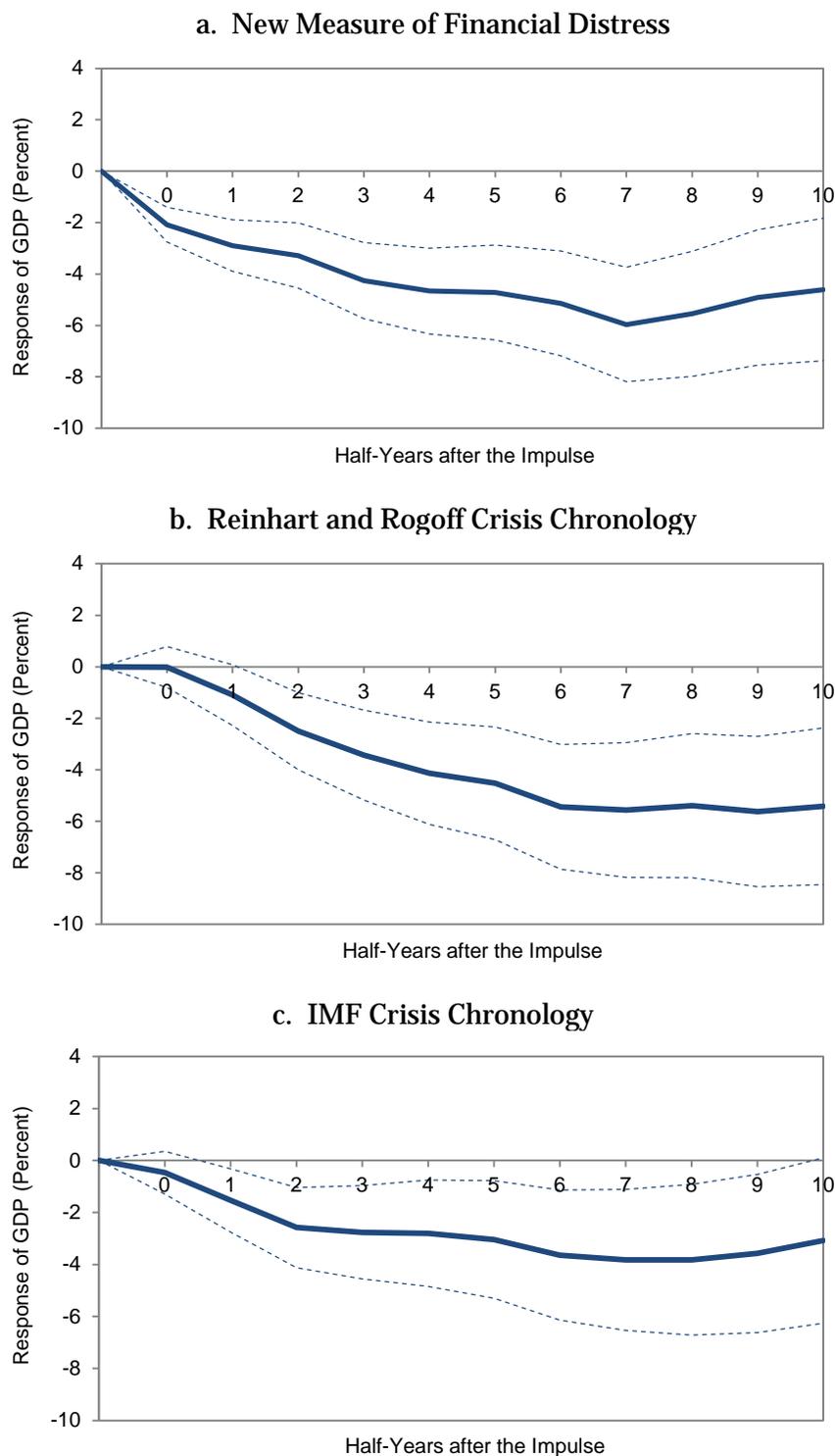
Notes: Panel (a) shows the impulse response function for real GDP to an impulse of 7 in our new measure of financial distress derived from estimating equation (1) for the sample of 24 OECD countries using OLS. Panels (b) and (c) show the impulse response functions for GDP to an impulse of 1 in the Reinhart and Rogoff and IMF crisis series, respectively, derived from estimating equation (1) for the same sample of OECD countries we analyze. The dashed lines show the two-standard-error confidence bands.

FIGURE 6
Response of Outcome Variables to Financial Distress, Full Sample, GLS

a. Real GDP

b. Industrial Production
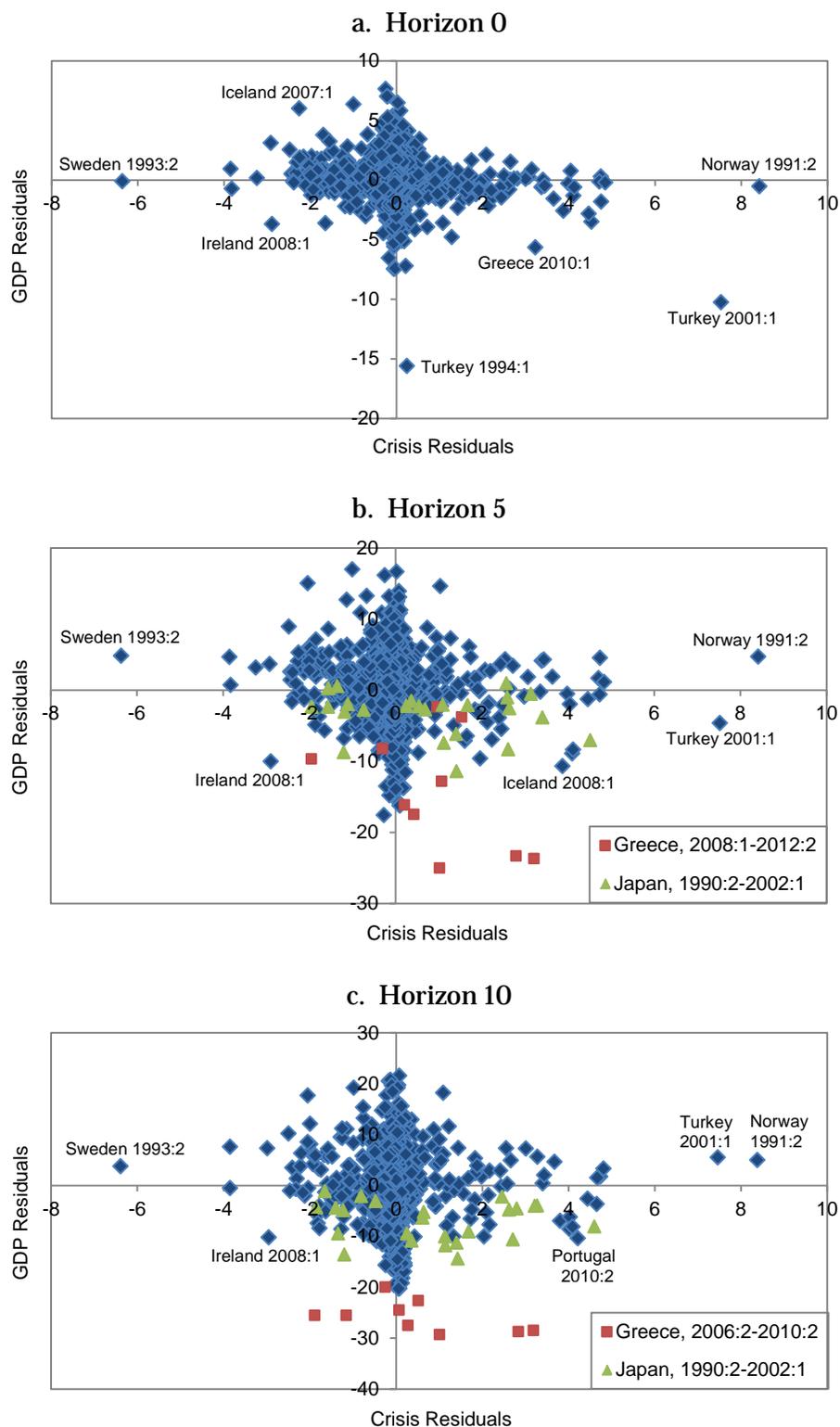

c. Unemployment

Notes: The figures show the impulse response functions for various outcome variables to an impulse of 7 in our new measure of financial distress derived from estimating equation (1) for the sample of 24 OECD countries over the full sample period using generalized least squares (GLS). See text for details. The dashed lines show the two-standard-error confidence bands.

FIGURE 7
Response of Real GDP to Financial Distress, Alternative Timing Assumptions

a. Distress in *t **Can*** Affect Output in *t* (Baseline)

b. Distress in *t **Cannot*** Affect Output in *t*
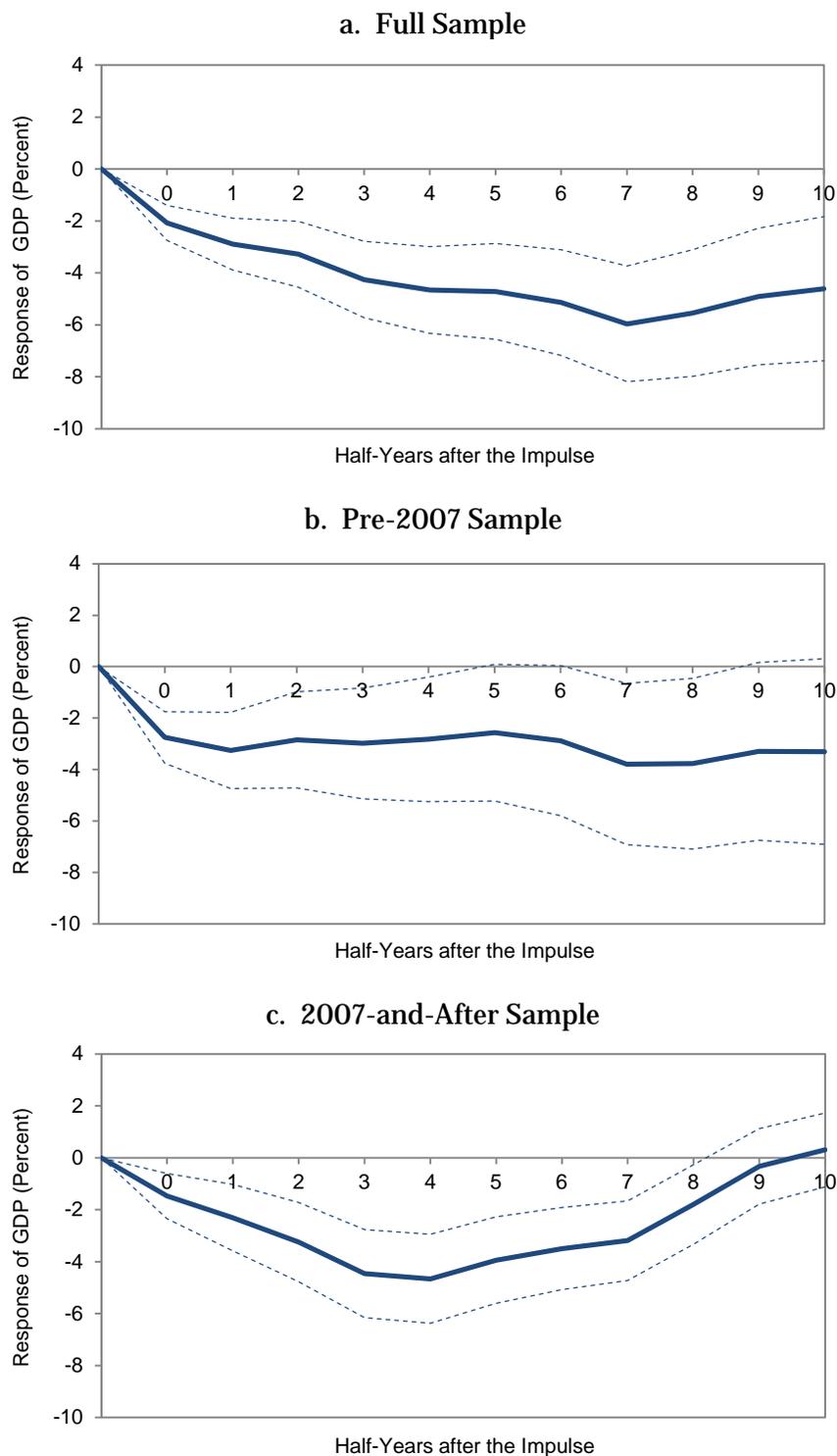

c. Distress in *t*+1 ***Can*** Affect Output in *t*

Notes: Panel (a) shows the baseline impulse response function for real GDP to an impulse of 7 in our new measure of financial distress derived from estimating equation (1) for the sample of 24 OECD countries over the full sample period using OLS. Panel (b) shows the impulse response function derived from estimating equation (2). Panel (c) shows the impulse response function for GDP derived from estimating equation (1), but replacing F_t with F_{t+1}. The dashed lines show the two-standard-error confidence bands.

FIGURE 8
Partial Association of Real GDP and Financial Distress at Various Horizons
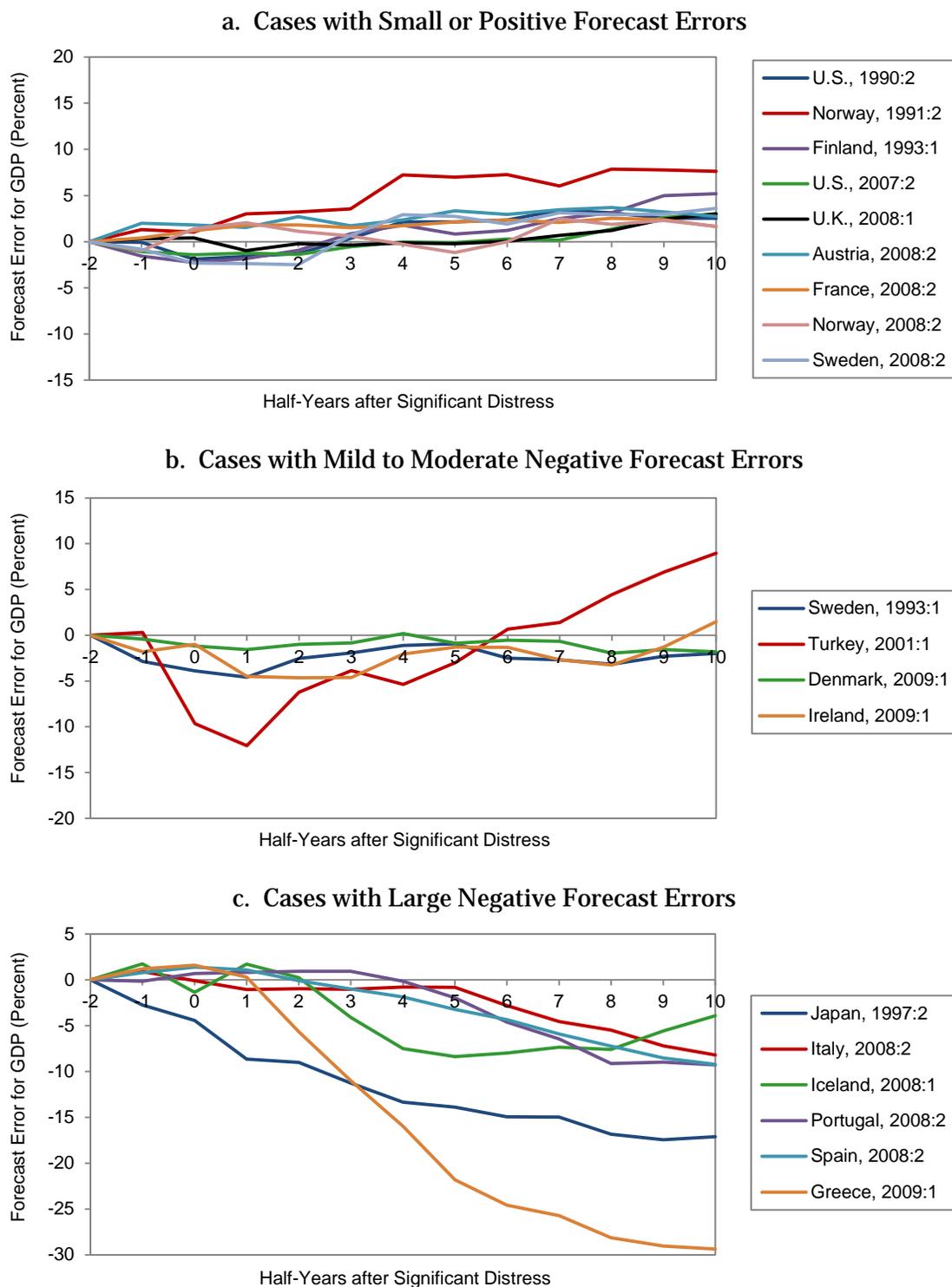
a. Horizon 0

b. Horizon 5

c. Horizon 10

Notes: The figures show the partial association between real GDP at horizons t, $t+5$, and $t+10$, respectively, and financial distress at t, derived from estimating equation (1) for the full sample of 24 OECD countries over the full sample period using OLS.

FIGURE 9
Response of Real GDP to Financial Distress, Splitting the Sample in 2007:1

a. Full Sample

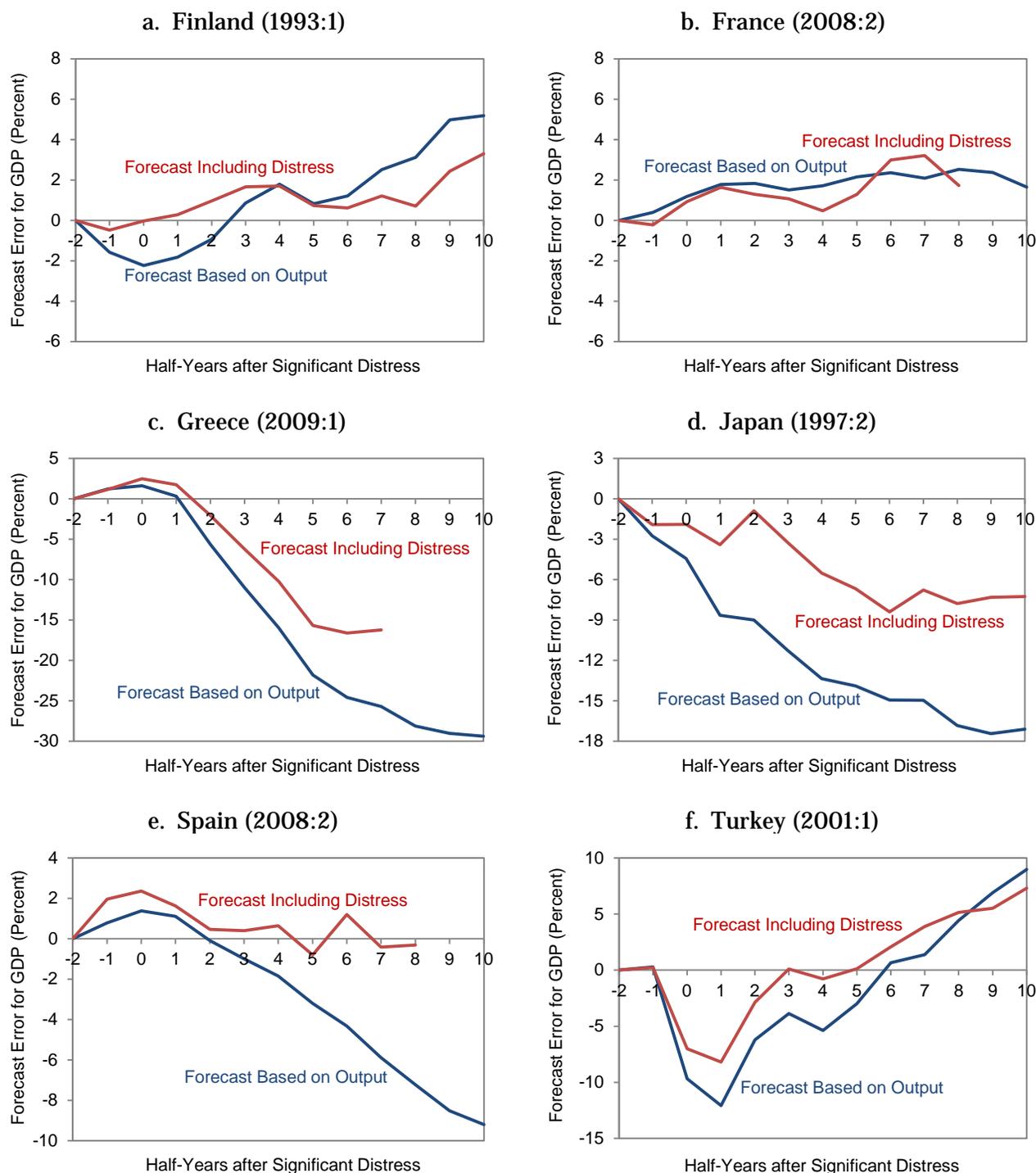### b. Pre-2007 Sample

c. 2007-and-After Sample

Notes: The figures show the impulse response function for real GDP to an impulse of 7 in our new measure of financial distress derived from estimating equation (1) for the sample of 24 OECD countries using OLS. Panel (a) shows the baseline results from the full sample period; panel (b) shows the results from the sample ending in 2006:2; and panel (c) shows the results using the sample starting in 2007:1. The dashed lines show the two-standard-error confidence bands.

FIGURE 10

Univariate Forecast Errors for Episodes where Financial Distress Reached 7

a. Cases with Small or Positive Forecast Errors

b. Cases with Mild to Moderate Negative Forecast Errors

c. Cases with Large Negative Forecast Errors

Notes: The figures show the forecast errors for real GDP (defined as actual minus forecast) following episodes of significant financial distress. The date given for each episode is when distress reached 7. The forecast, which is based just on lagged output, is derived by estimating equation (3), and uses actual data up through a year (two half-years) before the distress variable reached 7. The cases are sorted into rough categories based on how negative the forecast errors are.

FIGURE 11

Univariate and Expanded Forecast Errors for Selected Episodes where Distress Reached 7

a. Finland (1993:1)

b. France (2008:2)

c. Greece (2009:1)

d. Japan (1997:2)

e. Spain (2008:2)

f. Turkey (2001:1)

Notes: The figures show the forecast errors for real GDP (defined as actual minus forecast) following episodes of significant financial distress. The date given in parentheses is when the new measure reached 7. The forecast based on output is derived by estimating equation (3), and uses actual data up through a year (two half-years) before the distress variable reached 7. The forecast including distress is derived by estimating equation (4), and uses output through a year before the distress variable reached 7 and the actual financial distress series through the date being forecast.

FIGURE 12
Response of Real GDP to Financial Distress, Full Sample,
Comparing Linear and Nonlinear Specifications
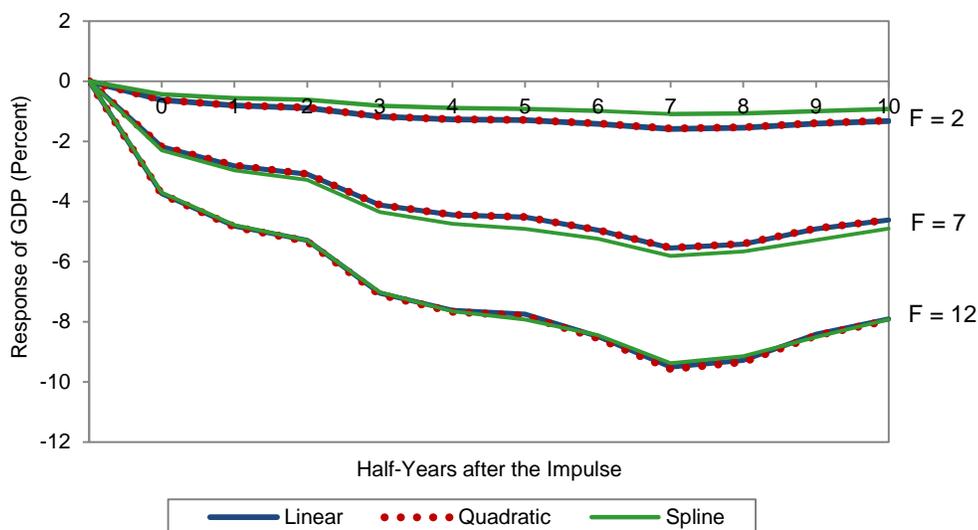
Notes: The figure shows the impulse response functions for real GDP to the new measure of financial distress rising from 0 to 2, 0 to 7, and 0 to 12, estimated for the sample of 24 OECD countries over the full sample period. For each value of distress, we show the impulse response function estimated three ways: the baseline linear specification; a quadratic specification that includes both the level and the square of the financial distress variable; and a spline specification that allows the quadratic term to change at two knot points. See text for details.

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