Review of Economic Dynamics 16 (2013) 724–744

Contents lists available at SciVerse ScienceDirect

Review of Economic Dynamics

www.elsevier.com/locate/red

Business cycle accounting East and West: Asian finance and the investment wedge ☆

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A R T I C L E I N F O

Article history:
Received 11 March 2010
Received in revised form 5 October 2012
Available online 17 October 2012

JEL classification:
E13
E32
G01
O47

Keywords:
Business cycle accounting
Financial crises
Output drops
Recoveries

A B S T R A C T

While a large literature studies the causes of financial crises, little is known about the mechanisms by which crises lead to output drops. We perform an exploratory analysis of output drops by applying the Business Cycle Accounting (BCA) methodology developed by Chari et al. (2007) to a sample of 23 crises. The BCA procedure estimates the wedges, and thus the kinds of distortions, that are most relevant in explaining output movements in each episode. Our results make a case for separating East Asian crises, which are mostly driven by the efficiency and investment wedges, from crises elsewhere, which are mostly driven by the efficiency and labor wedges. These findings are consistent and complementary with studies of Asian financial systems, which highlight the influence of Japanese institutions and practices, including relationship-based as opposed to market-based lending, and reluctance to impose bankruptcy.

1. Introduction

Over the last three decades, international financial crises have struck in countries as diverse as Argentina, Korea, Turkey and Finland. Typical symptoms of crises have been large real depreciations, current account reversals (or sudden stops), difficulties in the banking sector and, in some cases, sovereign default. Most importantly, financial crises have also typically led to sharp drops in output, and it is for this reason that they are a topic of perennial interest for academic economists and policymakers alike.

Recurrent waves of financial disasters have led to the development of three generations of models examining the causes of crises. Latin American crises in the 1970s and 1980s motivated first generation models (e.g., Krugman, 1979; Flood and Garber, 1984), highlighting the incompatibility of fixed exchange rates with monetized fiscal deficits. The European ERM crisis of 1992/93 and Mexico's 1994/95 episode led to second generation theories (e.g., Obstfeld, 1994; Cole and Kehoe, 1996, 2000), emphasizing multiple equilibria and self-fulfilling prophecies. And after the crises of the second half of the 1990s, third generation models (e.g., Burnside et al., 2001; Schneider and Tornell, 2004) tended to stress the role of government guarantees and currency mismatches in private sector balance sheets. However, as noted by Calvo (2000),

☆ This paper has benefited from discussion with or comments by Richard Baillie, Suparna Chakraborty, Do Won Kwak, Felipe Meza, Zeynep Senyuz, as well as by the editor of this journal, Ellen McGrattan, and two anonymous referees. We are grateful to participants at various conferences and seminars for their helpful comments and suggestions. We would also like to thank Ellen McGrattan for generously making her MATLAB codes available. All remaining errors are our own.

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1094-2025/$ – see front matter
http://dx.doi.org/10.1016/j.red.2012.10.003

while all three generations have provided valuable insights into how and when crises are possible, they have had less to say about the mechanisms through which crises lead to output drops. In all three generations, typically, the objective is to determine conditions under which markets can force governments to abandon currency pegs and/or default, *assuming* that the abandonment/default has adverse real effects. This assumption is often made because it is difficult to generate output drops endogenously. In fact, in many environments, crises may raise output, as real depreciations improve net exports.

The literature seeking to identify mechanisms by which crises lead to output drops is relatively more recent and less extensive. Regarding output drops in specific episodes, to our knowledge, the cases that have been most extensively studied are Mexico in 1994/95 and Korea in 1997/98. In the context of the "Tequila" crisis, Meza (2008) finds that changes in fiscal policy account for about 20 percent of the output drop in Mexico in 1995, while Kehoe and Ruhl (2009) find that reallocation from nontradable to tradable sectors explains the evolution of the real exchange rate and trade flows, but not the drop in output and total factor productivity (TFP). In the case of Korea's 1997/1998 crisis, Benjamin and Meza (2009) develop a model of sectoral reallocation which takes into account the effect of high interest rates on firms' working capital, and show that the model accounts for about half of the decline in GDP and TFP.

In this paper, instead of studying the role of specific frictions in a given episode, our approach is to perform an exploratory analysis of output drops throughout a sample of crises. We employ the Business Cycle Accounting (BCA) methodology developed by Chari et al. (2007) (CKM henceforth). BCA decomposes output fluctuations into fluctuations due to changes in an efficiency wedge, a labor wedge, an investment wedge and a government consumption wedge. The efficiency wedge captures shocks to TFP. The labor and investment wedges capture frictions distorting the intratemporal choice between consumption and leisure and the intertemporal Euler equation, respectively. Finally, the government consumption wedge captures government purchases plus net exports. After estimating the processes governing all wedges, we use simulations where some wedges vary and others are held constant to discern which kinds of distortions play the most important role accounting for observed fluctuations. Thus, BCA provides a priori guidance for economists seeking to explicitly model frictions. One important question that this analysis will help us answer is to what extent crises are alike. If a similar combination of wedges accounts well for the data in all (or most) episodes, it may be possible to develop a single model with general applicability. On the other hand, if different crises, or clusters of crises, are driven by different sets of distortions, it may be preferable to develop multiple models tailored to the different varieties.

To construct our sample, we start from the list of episodes compiled by Kaminsky (2006). After dropping some cases due to data limitations, we are left with the following 23 episodes, involving 13 countries: Argentina (1981, 1985, 1989, 1994, 2001), Brazil (1987, 1991, 1999), Chile (1982, 1998), Finland (1991), Indonesia (1997), Israel (1983), Korea (1997), Malaysia (1997), Mexico (1982, 1994), Philippines (1983, 1997), Sweden (1992), Thailand (1997), and Turkey (1994, 2000). The sample offers variation along several potentially interesting dimensions, such as size of the output drop, time of the crisis, inflation, severity of banking problems, etc. Moreover, the countries in the sample are spread across different regions of the world with markedly different histories and institutions.

After applying the BCA methodology to all cases, the dominance of the efficiency wedge becomes immediately apparent. It is the most important wedge in virtually all cases, explaining on average about 60 percent of the output drop in the crisis year. The labor wedge comes second, accounting on average for 20 percent of the drop, and the investment wedge third, accounting for an average of 14 percent. Regarding recoveries, we find that in the three years after the crisis year, the order of importance of the wedges remains the same. The efficiency wedge comes first, the labor wedge second, and the investment wedge third. The government consumption wedge plays a negligible role in both drops and recoveries.

In light of previous studies, these average contributions are unsurprising. What is new in our paper is the finding that, behind these averages, there is substantial variation between cases. The variation is systematic enough to suggest that crises in Asia—meaning Indonesia, Korea, Malaysia, the Philippines, and Thailand—share characteristics which set them apart from crises in other regions. Specifically, Asian crises in our sample are significantly deeper and more investment-driven than crises elsewhere. Regarding severity, the drop in (detrended) output in the crisis year is significantly larger in Asian crises than in the rest of the sample. Moreover, this output loss persists, as growth in the recovery years fails to narrow the gap with the pre-crisis trendline. Moreover, in Asian crises, the investment wedge plays a much more important role than the labor wedge, whereas the opposite holds in European and Latin American crises. The investment wedge explains roughly 35 percent of the output drop in East Asia, a significantly higher percentage than the 6 percent average in non-Asian crises.

Given that Asian crises are comparatively deeper, more investment-driven, and less labor-driven than non-Asian crises, it is not surprising that crisis severity correlates positively with the importance of the efficiency and investment wedges and negatively with the labor wedge. These correlations, however, are only statistically significant within the Asian subsample, and not in the overall sample. Regarding the dynamic properties of wedges, the labor wedge is more mean-reverting than the efficiency and investment wedges. That is, in crises where the labor wedge has a sizable contribution to the drop, it also has a significantly higher contribution to the recovery. By contrast, for the efficiency and investment wedges, the contributions to the drop and to the recovery are not significantly correlated. When we examine the roles of the different wedges in the three years after the crisis, we find that post-crisis growth is significantly faster the greater the contribution of the efficiency wedge to the recovery and the greater the contribution of the investment wedge to the recovery. For all results, we verify that the coefficients and significance levels obtained via plain correlations/regressions are not too different from those obtained by means of an outlier correction method, which reduces or eliminates the weight of influential observations. We find that our results do not appear to be driven by outliers.

To interpret our findings, it is useful to turn to the literature on Asian financial systems. According to Cargill and Parker (2002), Johnson et al. (2000), and others, East Asian financial systems tend to be similar to each other, and different from Western ones. This owes much to the influence of the Japanese economic model, viewed for decades as a blueprint for success. Similarities with Japanese institutions are strongest for Korea, remarkable in Indonesia, Malaysia, and Thailand, and—according to Nelson (2007)—weakest for the Philippines. The Japanese/Asian model is often described as a model of relationship-based lending, in contrast to the Western model of market-based lending. Amid strong state–bank–firm ties, credit is preferentially allocated to well-connected, large borrowers. Investments are made with a long-term view rather than a short-term focus on next-quarter earnings. A lower degree of reliance on market discipline also manifests itself in extreme reluctance to impose bankruptcy, especially on large firms. According to Cargill and Parker (2002), although Asian systems generate higher rates of investment and growth than Western ones for some time, they are bound to deliver slower long-run growth because they subsidize failing firms instead of periodically cleansing the economy of inefficient operations. Thus, a backlog of nonperforming loans accumulates, and if policy changes or other shocks precipitate crises, these tend to be deeper, more persistent, and characterized by drastic drops in investment. Along several key dimensions, our analysis is consistent with this theory. In our sample, the investment-to-GDP ratios in excess of 40 percent observed in Indonesia, Korea, Malaysia and Thailand before the crisis are substantially higher than those in other countries. These rates of investment plunge dramatically, bringing output with them, and fail to recover in the years after the crisis. We also collect information on nonperforming loans and find that, as predicted by the theory, Asian crises have a significantly higher ratio of nonperforming loans to total loans. Other measures of banking distress, such as fraction of banks closed and drop in real bank credit to the private sector, are also higher for Asian crises, although the difference is below—in some instances just below—the threshold for statistical significance. Finally, we contrast our findings against the study of Johnson et al. (2000), who construct measures for institutional features generally referred to as "crony capitalism". While some of their measures yield insignificant results, their measure of minority shareholder rights is significantly lower for the Asian subsample.

Previous BCA studies are both consistent and complementary with ours. In fact, CKM, Ahearne et al. (2006), Kersting (2008), Cociuba and Ueberfeldt (2008) and Lama (2011), found the efficiency and labor wedges to account for practically all of the fluctuations in, respectively, the United States, Ireland, the UK, Canada, and six Latin American countries. In all of these studies, the investment wedge plays a tertiary, minor role. These findings contrast with Chakraborty's (2009) analysis of Japan, which found the efficiency and investment wedges to be most important, attributing a minor role to the labor wedge. Clearly, our results concerning Asia and the investment wedge are validated by the findings of other BCA studies, especially in light of our interpretation regarding the influence of the Japanese model.

The rest of the paper is organized as follows. In Section 2, we introduce the model and describe the measurement and accounting procedure. In Section 3, we describe our data. In Section 4 we present our results, which we discuss and interpret in Section 5. In Section 6, we conclude.

2. The model and business cycle accounting procedure

2.1. The model

Following CKM, here, we sketch the model and accounting procedure. The model is a standard neoclassical growth model. Every period t, the economy is hit by one of a finite number of events s_t. The history of realized events up to period t is denoted by $s^t = (s_0, \dots, s_t)$. The initial realization of the event s_0 is exogenously given. As of period 0, $\pi_t(s^t)$ denotes the probability of any particular history s^t. The economy has four stochastic variables which depend on s^t: the efficiency wedge $A_t(s^t)$, which acts like time-varying productivity; the labor wedge $1 - \tau_{lt}(s^t)$, which is akin to a time-varying tax on labor income; the investment wedge $1/[1 + \tau_{xt}(s^t)]$, which has the same effect as a time-varying tax on investment, and the government consumption wedge $g_t(s^t)$, which resembles government expenditure.[1,2]

The population N_t is assumed to grow at the constant rate γ_n. The representative consumer chooses per capita consumption $c_t(s^t)$ and per capita labor $l_t(s^t)$ to maximize

$$\sum_{t=0}^{\infty} \sum_{s^t} \beta^t \pi_t(s^t) U(c_t(s^t), l_t(s^t)) N_t,$$

where $\beta \in (0, 1)$ is a discount factor. Utility maximization is subject to the budget constraint

$$c_t(s^t) + [1 + \tau_{xt}(s^t)][(1 + \gamma_n)k_{t+1}(s^t) - (1 - \delta)k_t(s^{t-1})] = [1 - \tau_{lt}(s^t)]w_t(s^t)l_t(s^t) + r_t(s^t)k_t(s^{t-1}) + T_t(s^t),$$

[1] Several modifications of the BCA model, which incorporate additional wedges, have been developed, often with the objective of tailoring the procedure to developing economies. Despite the merits of the extensions, we have chosen to stick to the baseline BCA model because, in our judgment, it remains the most standard and commonly used version. By employing the well-known original version, we hope that it will be easier to compare our findings with those of existing and future studies. Moreover, some countries in our sample, e.g., Finland, are developed countries.

[2] While we only present the baseline model here, we have re-run all our analyses in the case of variable capital utilization (VCU). An Appendix describing the VCU model and results is available at the RED website.

where $k_t(s^{t-1})$, $[(1+\gamma_n)k_{t+1}(s^t)-(1-\delta)k_t(s^{t-1})]$, and $T_t(s^t)$ are, respectively, per capita capital, per capita investment and per capita lump-sum taxes/transfers. The wage rate and rental rate on capital are denoted, respectively, by $w_t(s^t)$ and $r_t(s^t)$, and δ is the rate at which capital depreciates.

Every period t, firms choose per capita capital $k_t(s^{t-1})$ and per capita labor $l_t(s^t)$ to maximize profits

$$A_t(s^t)F\big(k_t(s^{t-1}),(1+\gamma)^t l_t(s^t)\big)-r_t(s^t)k_t(s^{t-1})-w_t(s^t)l_t(s^t),$$

where γ denotes the constant rate of labor-augmenting technological progress.

Equilibrium in the economy is fully described by

$$c_t(s^t)+\big[(1+\gamma_n)k_{t+1}(s^t)-(1-\delta)k_t(s^{t-1})\big]+g_t(s^t)=y_t(s^t), \tag{1}$$

$$y_t(s^t)=A_t(s^t)F\big(k_t(s^{t-1}),(1+\gamma)^t l_t(s^t)\big), \tag{2}$$

$$-\frac{U_{lt}(s^t)}{U_{ct}(s^t)}=\big[1-\tau_{lt}(s^t)\big]A_t(s^t)(1+\gamma)^t F_{lt}, \tag{3}$$

and

$$U_{ct}(s^t)\big[1+\tau_{xt}(s^t)\big]=\beta\sum_{s^{t+1}}\pi_t(s^{t+1}|s^t)U_{ct+1}(s^{t+1})\big\{A_{t+1}(s^{t+1})F_{kt+1}(s^{t+1})+(1-\delta)\big[1+\tau_{xt+1}(s^{t+1})\big]\big\}, \tag{4}$$

where U_{ct} and U_{lt} denote the first derivatives of the utility function with respect to consumption and labor and similarly, F_{lt} and F_{kt} denote the first derivatives of the production function with respect to labor and capital. Eq. (1) is the feasibility constraint of the economy. Eq. (2) is the production function. Eq. (3) states that in equilibrium, the marginal rate of substitution between consumption and leisure equals the marginal product of labor, distorted by $\tau_{lt}(s^t)$. And finally, Eq. (4) is an intertemporal Euler equation, distorted by $\tau_{xt}(s^t)$ and $\tau_{xt+1}(s^{t+1})$.

As CKM and Chakraborty (2009) emphasize, the wedges or frictions represent all possible distortions that can enter the first order conditions. For example, a labor wedge may arise because of labor market distortions—such as a labor income tax—but also for many other reasons, such as mismeasurement in the presence of intangible capital, as in McGrattan and Prescott (2010). Frictions may arise from a variety of sources, such as taxes, monopoly power by unions or firms, sticky wages or sticky prices. CKM generalize these results by illustrating the mapping, and showing that explicitly modeled frictions map into wedges in this prototype economy. For example, input-financing frictions map into efficiency wedges, investment-financing frictions into investment wedges, and fluctuations in net exports in an open economy map into government consumption wedges.

Consequently, by construction, the model exactly reproduces the data on output, labor, investment, and consumption when all four wedges are jointly fed into the model.

2.2. The business cycle accounting procedure

2.2.1. How to measure the wedges

As in CKM, we assume that the mapping from the event s_t to all the wedges is one to one and onto. The accounting procedure is to conduct experiments that isolate the marginal effect of each wedge as well as the marginal effects of combinations of the wedges on aggregate variables. For example, in conducting the experiment that isolates the marginal effect of the investment wedge, we hold all other wedges fixed at some constant levels in all periods.

To implement the accounting procedure, we assume that the production function has the Cobb–Douglas form

$$F(k,l)=k^\alpha l^{1-\alpha},$$

where α is the capital share and the utility function is of the form

$$U(c,l)=\log c+\psi\log(1-l),$$

where ψ denotes the time allocation parameter. We borrow parameter values from the business cycle literature. Concretely, in Table 1, we describe our sources and numerical values for each country. We then use these values together with the data to derive the steady state value of the wedges.

To measure the wedges, note that the efficiency wedge A_t and the labor wedge τ_{lt} can be directly calculated from Eqs. (2) and (3) without computing the equilibrium of the model. Also, following CKM, we measure the government wedge g_t directly from the data as the sum of government spending and net exports.[3] Measuring the investment wedge τ_{xt} is not as straightforward. Since the Euler equation (4) involves expectations over time, and agents' optimal decision rules depend on the stochastic process driving the wedges, measuring this wedge requires that we compute the equilibrium of the model.

[3] Meza (2008) adds net exports to investment rather than government spending since he analyzes the role of actual fiscal policy.

Table 1
Benchmark model parameter values.

Parameter values	Argentina	Brazil	Chile	Finland	Indonesia	Israel	Korea	Malaysia	Mexico	Philippines	Sweden	Thailand	Turkey
Technological progress rate (γ)	0	0	0.020	0.024	0.024	0.015	0.053	0.034	0	0	0.020	0.038	0.012
Population growth rate (γ_n)	0.016	0.020	0.015	0	0.023	0.025	0.015	0.028	0.032	0.025	0	0.021	0.024
Discount factor (β)	0.920	0.900	0.98	0.98	0.96	0.95	0.98	0.96	0.962	0.964	0.95	0.917	0.900
Depreciation rate of capital (δ)	0.05	0.07	0.05	0.05	0.05	0.05	0.047	0.05	0.05	0.05	0.05	0.10	0.05
Time allocation parameter (ψ)	2.33	3.93	3.36	2.24	2.24	2.24	3.46	2.24	2.24	2.24	2.24	2.24	2.24
Capital share (α)	0.4	0.4	0.3	0.35	0.35	0.35	0.297	0.35	0.35	0.35	0.35	0.35	0.35

Note. The benchmark model parameter values were obtained from the business cycle literature: Argentina—Kydland and Zarazaga (2002), Brazil—Lama (2011), Chile—Bergoeing et al. (2002) and Simonovska and Soderling (2008), Korea—Otsu (2008), and Mexico—Meza (2008). For the remaining 8 countries, parameter values were obtained by calibration for the corresponding data.

To estimate the stochastic process for the state, we follow CKM and specify a VAR(1) process for the four dimensional state $s_t = (\log A_t, \tau_{lt}, \tau_{xt}, \log g_t)$. The process has the form

$$s_{t+1} = P_0 + P s_t + Q\varepsilon_{t+1},$$

where the shock is independent and identically distributed over time and is distributed normally with mean zero and covariance matrix V. The estimate of V is positive semi-definite, because we estimate the lower triangular matrix Q, where $V = QQ'$. We use the log-linear decision rules of the prototype economy along with data on output, labor, investment, and the sum of government spending and net exports. We use a standard maximum likelihood procedure to estimate the parameters P_0, P and V of the VAR(1) process for the wedges.[4]

We assume that the economy is in the steady state in pre-crisis year t, where the crisis year $t+1$ is defined as the year with the greatest output drop. We solve the model using log-linearization and the method of undetermined coefficients. The model is expressed in state-space form as follows

$$X_{t+1} = AX_t + B\epsilon_{t+1},$$
$$Y_t = CX_t + w_t, \tag{5}$$

where $X_t = [\log \hat{k}_t, \log z_t, \tau_{lt}, \tau_{xt}, \log \hat{g}_t, 1]'$, $z_t = A_t/(1+\gamma)^t$, $Y_t = [\log \hat{y}_t, \log \hat{x}_t, \log l_t, \log \hat{g}_t]'$, and $w_t = Dw_{t-1} + \eta_t$. The matrix A summarizes coefficients linking X_t to X_{t+1}, including the coefficients in matrices P and P_0 from the above process and the coefficients linking X_t to $\hat{k}_{t+1}$ (found via log-linearization and the method of undetermined coefficients). The matrix B summarizes variance–covariance parameters, including Q from the VAR(1) process above. Finally, C summarizes the coefficients linking X_t to Y_t (found via log-linearization and the method of undetermined coefficients), and elements of D are the parameters governing serial correlation of the measurement error. We assume that $E(\eta_t\eta_t') = 0_{4\times4}$ and $E(\epsilon_t\eta_s') = 0$ for all periods t and s. In all periods and all numerical experiments, we also set the measurement errors equal to zero (i.e. $D = 0_{4\times4}$).

The log-likelihood function to be maximized is given by

$$L(\Theta) = \sum_{t=0}^{T-1} \left\{\log|\Omega_t| + \operatorname{trace}\left(\Omega_t^{-1}u_t u_t'\right) - \log\left|\partial f(Z_t, \Theta)/\partial Z_t\right|\right\}, \tag{6}$$

where the parameters to be estimated are in vector Θ, u_t is the innovation vector, and Ω_t is its covariance. The last term in (6) is nonzero if the elements of Y are not the raw series but depend on the raw series Z plus the parameter vector. This last term f is a penalty function that ensures stationarity of the shock processes. It is proportional to $\max(|\lambda_{\max}| - 0.995, 0)^2$, where $\lambda_{\max}$ is the maximal eigenvalue of the matrix P. To illustrate what this means, in a model with only one shock, the penalty term would ensure that the shock's autocorrelation coefficient is below one in absolute value.

Following CKM, for the results reported, we fix parameters of preferences, production, and growth and estimate the processes for the wedges. The parameters to be estimated are elements of P_0, P and Q. The log-likelihood function above is obtained using the Kalman filter, which generates one-period-ahead predictions compared to the actual data. The differences between the actual data and the predictions generated by the filter enter into the log-likelihood function. Once we have estimated P_0, P and V, we can find the realized values of the wedges. (For more technical details, see Appendices of Chari et al., 2006.)

2.2.2. Evaluating the contribution of each wedge

Having measured realized values for the four wedges, we now implement the simulations that allow us to determine the extent to which output fluctuations can be attributed to each wedge. For each episode, we let t and $t+1$ denote, respectively, the pre-crisis and the crisis year. To determine the relevance of a given wedge, we simulate the model letting that wedge vary only up to the pre-crisis year t, and holding that wedge fixed at its pre-crisis level from time $t+1$ onwards, so as to nullify the effect of changes in that specific wedge.[5] For instance, to compute the share of the drop due to the efficiency wedge, we conduct a simulation in which we feed into the model the full series for the labor, investment, and government consumption wedges, together with a truncated efficiency wedge, which equals the realized wedge for years up to the pre-crisis year t but is held constant at its year-t level from the crisis year $t+1$ onwards. Using the same method, we evaluate the importance of the labor, investment, and government consumption wedges, accordingly.

We feed the truncated wedge along with the other wedges into the model. The greater the difference between the actual and the predicted output drops, the greater the importance of the truncated wedge. For brevity, we will not report results

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[4] As the yearly-data analysis in CKM, we impose the additional restriction that the covariance between the shocks to the government consumption wedge and those to all other wedges is zero. In other words, we assume that the government consumption wedge is uncorrelated with all other wedges for the structure of the matrix.

[5] Meza (2008) constructs counterfactual wedges that eliminate the effect of changes in fiscal policy. He solves the fiscal policy model to find the relation between wedges and fiscal policy variables.

Table 2
Changes in output (detrended), labor, and investment (detrended).

Country	Pre-crisis year	Change (%)		
		Output (detrended)	Labor	Investment (detrended)
Argentina	1980	−6.84	−2.38	−16.32
	1984	−6.81	−0.41	−17.90
	1988	−8.26	−0.24	−23.64
	1994	−4.07	−5.75	−13.70
	2001	−13.17	−7.20	−26.75
Brazil	1987	−2.37	−0.32	−0.28
	1991	−2.77	−4.02	−8.21
	1998	−1.91	−1.20	−5.65
Chile	1981	−15.45	−12.32	−33.41
	1998	−4.08	−3.24	−23.50
Finland	1990	−8.98	−5.81	−22.46
Indonesia	1997	−19.54	−4.27	−57.49
Israel	1983	−1.66	−0.54	−13.51
Korea	1997	−11.59	−8.28	−39.45
Malaysia	1997	−13.20	−3.37	−46.12
Mexico	1981	−4.17	0.62	−19.61
	1994	−8.41	−0.04	−18.63
Philippines	1983	−8.66	−2.94	−37.21
	1997	−2.75	−6.02	−20.18
Sweden	1991	−3.48	−4.87	−15.44
Thailand	1997	−15.08	−0.50	−48.42
Turkey	1993	−10.63	−0.01	−30.49
	2000	−10.73	−0.46	−39.50
Average		−8.03	−3.20	−25.12

Note. Output (detrended) and investment (detrended) are real values per person aged 15–64.

with the truncated government consumption wedge since, in our sample, as well as in previous studies, there is virtually no difference between the output path in the data and the output path predicted by the model that ignores changes in this wedge from the crisis year onward.

3. Data

To build our sample, we begin with the list of crises compiled by Kaminsky (2006). After dropping cases due to data limitations, 13 countries and 23 crisis episodes remained in our sample. The crises in our sample occurred mostly during the 1980s and 1990s, and some in the early 2000s, and involved the following countries: Argentina, Brazil, Chile, Finland, Indonesia, Israel, Korea, Malaysia, Mexico, Philippines, Sweden, Thailand, and Turkey. The crises were on average quite severe. In fact, the average output drop between the pre-crisis year t and the crisis year $t+1$ is approximately 8 percent. In Table 2, we show, along with the percentage drops in output, the percentage drops in employment and investment, for each case. The average drop in employment, at 3.2%, is smaller than the drop in output. Investment, on the other hand, is much more volatile than output, and registers an average drop of about 25%.

Most of our data are from the *International Financial Statistics* (*IFS*) database. The only series that are not from this source are working-age population (i.e., population aged 15–64), total employment, and hours worked, which are collected from the *International Labour Office* (*ILO*) *LABORSTA* database. With the exception of Turkey, for which data start in 1988, for all other countries, the first year is 1980. The last year differs by country, varying between 2005 and 2007.

The series for per capita output (y), per capita investment (x), per capita labor input (l), per capita government consumption (g) and per capita consumption (c) are constructed as follows. Per capita output (y) is the sum of nominal GDP, deflated using the GDP deflator and dividing by population aged 15–64. In the case of Mexico, we added services from, and depreciation of, consumer durables to GDP. We were not able to find this information for other countries. Whenever data availability allows it, we follow CKM in subtracting sales taxes from the original GDP. However, we were only able to find sales tax data for Korea and Mexico. Thus, for these two countries, the GDP series we use is the series after subtraction of sales tax data. For all other countries, we use the GDP series without subtracting sales taxes. The series for per capita investment (x) is given by gross fixed investment (plus personal consumption expenditures on durables in the case of Mexico), deflated and divided by population aged 15–64. Using both the law of motion for capital and the perpetual inventory method, we calculate the series for per capita capital stock (k). To construct the series for the per capita labor input (l), we multiply annual hours worked per employed person by total employment, and divide the result by population aged 15–64. Since the value obtained is total hours worked per year, we divide it by the number of weeks per year (50) and the endowment of total hours per week (100). As mentioned earlier, the series for per capita government consumption (g) is the sum of government spending and net exports of goods and services, which, again, is deflated and divided by working-age population. By Eq. (1), the series for per capita consumption (c) is simply obtained by subtracting per capita investment (x) and per capita government consumption (g) from per capita output (y).

Regarding data on banking crises, our sources are the following. Data on percentages of banks closed and shares of nonperforming loans over total loans come from Laeven and Valencia (2008) and Reinhart and Rogoff (2009). We gathered data on credit extended from the World Bank's series "Domestic Credit Provided by Banking Sector (% of GDP)". We multiplied this series by nominal GDP (from *IFS*) to obtain nominal domestic credit provided by the banking sector, and deflated this series using the CPI series (also from *IFS*) to finally obtain real domestic credit. Finally, our data source for corporate governance in emerging markets is Johnson et al. (2000).

4. Results

The output paths and realized values for the efficiency, labor, and investment wedges for all countries are depicted in Fig. 1. Already at first glance, it is evident that there is a stronger association between output and the efficiency wedge than between output and the labor or investment wedge. This holds not only in crisis years—which stand out visually—but typically through the sample period. The importance of the labor or the investment wedge is more difficult to glean from Fig. 1, except for a few specific cases, such as the labor wedge in the Finnish crisis of 1990 and the investment wedge in the Indonesian crisis of 1997.

To quantify the importance of a given wedge for a given episode, our primary measure is the percentage contribution to the output drop in the crisis year. We compute this percentage by performing the following calculations, which resemble those employed by Meza (2008). Let $y_{i,t}$ and $y_{i,t+1}$ denote country i's real (detrended) per capita output in, respectively, the pre-crisis year t and the crisis year $t+1$, and let $d_{i,t} = (y_{i,t} - y_{i,t+1})/y_{i,t}$ be the corresponding percentage output drop. Next, for each wedge $w \in \{\text{Efficiency, Labor, Investment}\}$, we take output values from a simulation where we feed into the model realized values of wedges other than w, and a truncated series for w, which includes realized values of w only up to pre-crisis year t, but holds it fixed at its year-t level in later years. We let $\tilde{y}_{i,t+1}(w)$ denote the year-$t+1$ (detrended) per capita output generated by this simulation, and $\tilde{d}_{i,t}(w) = (y_{i,t} - \tilde{y}_{i,t+1}(w))/y_{i,t}$ denote the simulated percentage drop. Finally, we define $\Phi_{i,t}(w)$, the contribution of wedge w to the output drop in country i between years t and $t+1$ as

$$\Phi_{i,t}(w) = \frac{d_{i,t} - \tilde{d}_{i,t}(w)}{d_{i,t}}.$$

To interpret this measure, in Fig. 2 we plot the crisis and recovery phase in the case of Korea (1997). Panel A plots the data and the simulation for output with a truncated efficiency wedge, and Panels B and C plot the data and, respectively, a truncated labor and investment wedge. As we can see in Panel A, when the efficiency wedge is held constant, output falls by about 7 percentage points, whereas in the data, it falls by about 12 points. The difference of approximately 5 points, about 40%, is attributed to the efficiency wedge. Doing this for all wedges and crises, we obtain the contributions shown in Table 3. Not surprisingly, the efficiency wedge is usually largest, whereas the contributions of the labor and investment wedges vary widely between episodes. On average, the efficiency wedge accounts for 62.2% of the decline of output, the labor wedge for 21.7%, and the investment wedge for 14%.[6]

Two remarks are in order. First, in some instances, the contribution of a given wedge—as measured by $\Phi_{i,t}(w)$—is negative (e.g., the labor wedge in Indonesia in 1997). In these cases, the wedge completely misses the evolution of output, leading to an expansion instead of a contraction. The second remark is that, by construction, the sum of the fractions explained by different wedges need not equal one.

We also examine the effect of the wedges in the post-crisis years $t+1$ to $t+4$. Given that, over these three years, output recovers in some cases and falls or stagnates in others, we cannot use an analog of $\Phi_{i,t}(w)$ to measure the wedge's contributions. This would be problematic given the difficulty in interpreting signs, and the fact that in several cases, output at $t+1$ is very similar to output at $t+4$, which would make the denominator close to zero. In these cases, wedge contributions would be very large numbers, which would skew averages. To avoid these issues, we define an alternative measure as follows. For country i and wedge $w \in \{\text{Efficiency, Labor, Investment}\}$ the contribution to the recovery is given by

$$\varkappa_{i,t+1}(w) = \left[\tilde{y}_{i,t+1}(w) - y_{i,t+1}\right] - \left[\tilde{y}_{i,t+4}(w) - y_{i,t+4}\right].$$

This measure is simply the amount by which the gap between the predicted and actual outputs shrinks over the course of post-crisis years $t+1$ to $t+4$. Once more, Fig. 2 helps us interpret the measure. In the top panel, we can see that the gap between simulated and actual outputs does not shrink, but instead grows slightly, over the course of the years $t+1$ to $t+4$. Hence, the contribution of the efficiency wedge to recovery would be slightly negative. Calculating $\varkappa_{i,t+1}(w)$ in this fashion for all episodes and wedges, we obtain Table 4. As we can see, the efficiency wedge contributes most to recoveries, on average about 3.4 percentage points, whereas the labor wedge's average contribution to recoveries is positive, but close to zero, and the investment wedge's contribution averages minus 0.4 points.[7]

[6] It is worth noting that there is a high correlation (0.58 for labor and 0.47 for investment) between the contributions of the labor and investment wedges, given in Table 3, and the drops in labor and investment given in Table 2. Thus, although the reported measures of contributions focus on output, the importance of the labor and investment wedges is informative about the evolution of labor and investment.

[7] We re-run this analysis for the VCU case. Results—available in the appendix mentioned in footnote 1—are overall similar. The main difference is that the importance of the efficiency wedge falls and the contributions of the labor and investment wedges increase. On average, however, the efficiency wedge remains most important for drops and recoveries, followed in this order by the labor and investment wedges.

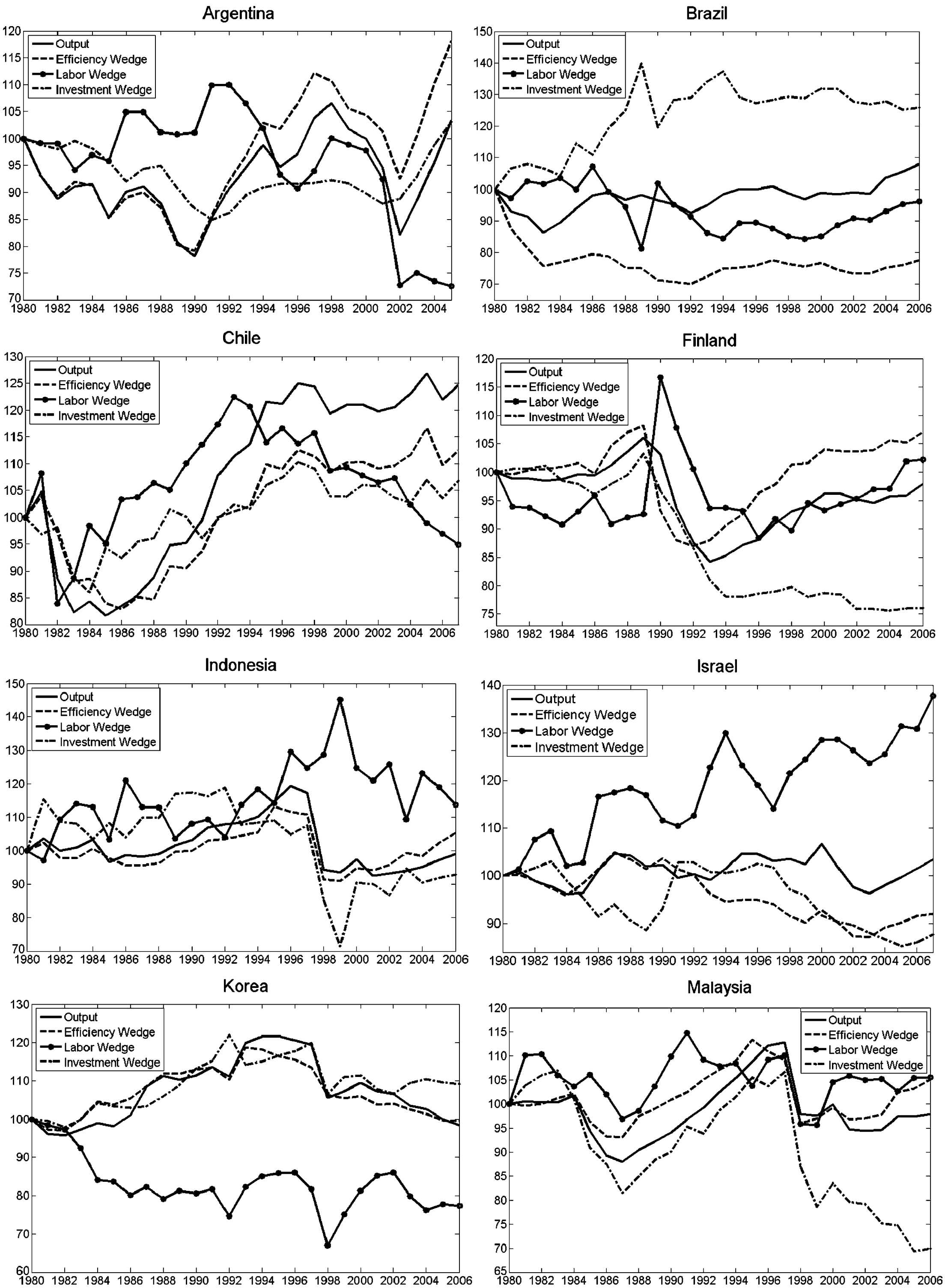

Fig. 1. Output paths and three measured wedges: All values are normalized to equal 100 in 1980. For Turkey, in 1988.

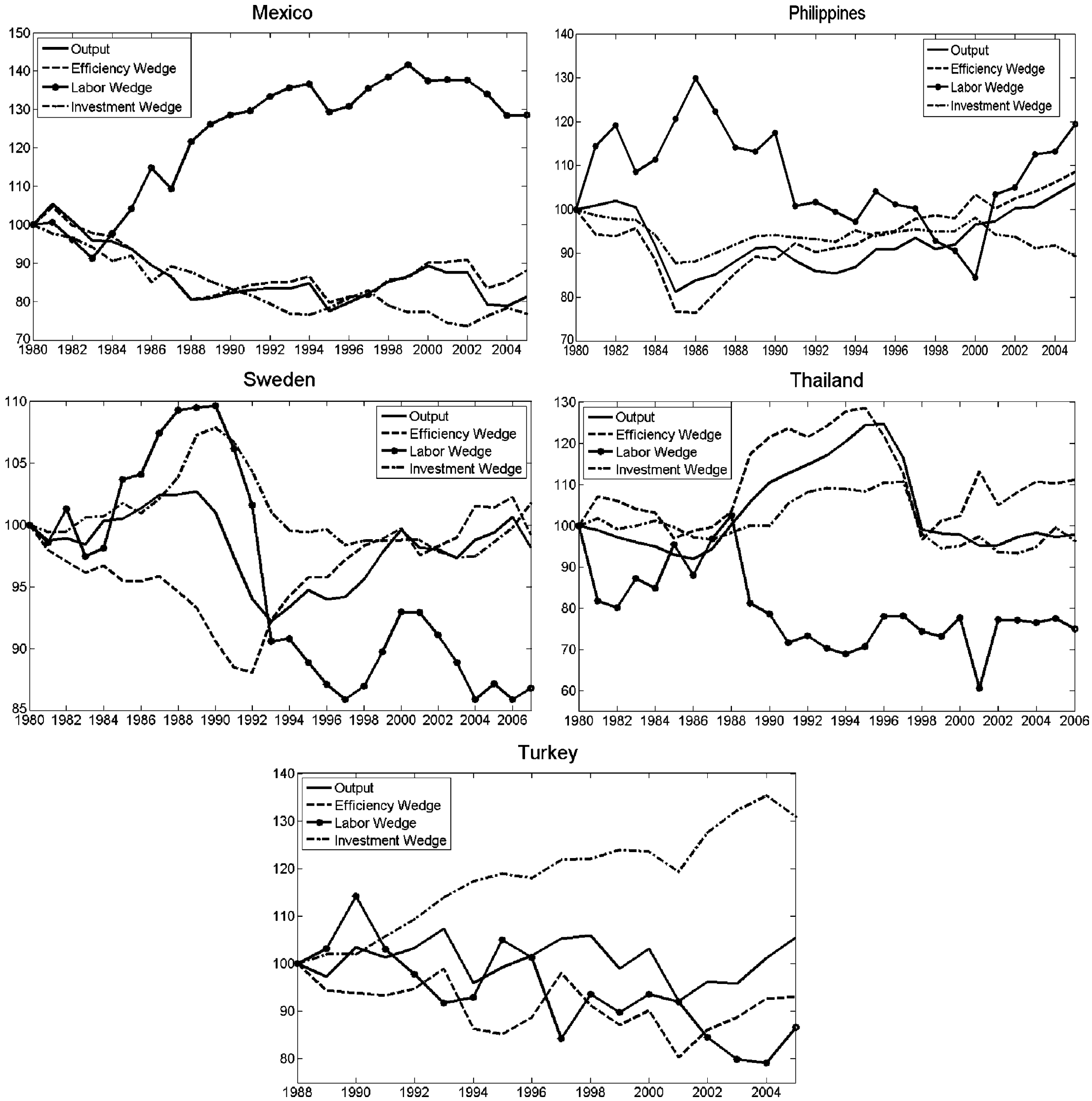

Fig. 1. (*continued*)

4.1. Wedges and observables

Our sample includes crises that are heterogeneous along a number of observable dimensions. For instance, the sample includes crises of different severity, occurring in different decades, in countries with diverse institutions and policies, etc. Associations between observables and wedges may provide hints as to what mechanisms or frictions underlie the distortions measured by the wedges, and thus may help us understand the driving forces behind crises and recoveries.

Even before discussing the wedges, some patterns can already be gleaned from Table 2. In particular, Asian crises appear to be deeper. Although crises have clearly been more frequent in Latin America, East Asian crises are more severe, posting double-digit drops in most cases. In the rest of the sample, such drops are much less frequent. Moreover, as shown in Table 4, Asian recoveries tend to be slower, failing to narrow the gap with the pre-crisis trend in the three years after the crisis. To confirm the sign and significance of these correlations, in Table 5, Panel A, we regress the size of the output drop on an Asian dummy variable, which equals one for Indonesia, Korea, Malaysia, the Philippines and Thailand, and zero otherwise. The coefficient is a significant 5.11 percent. We also regress the size of the recovery on the same Asian dummy, and find a coefficient that, while negative, is not quite significant with a p-value of 0.153. A third variable combines the previous two by subtracting the recovery from the drop to obtain the drop from t to $t+4$. Regressing this variable on the Asian dummy we obtain a statistically significant coefficient of 10.186. These results do not appear to be driven by outliers. For all three regressions, we obtain similar coefficients and significance levels when we run a robust regression—implemented using the *rreg* routine in STATA—that reduces or eliminates the weight of influential observations.

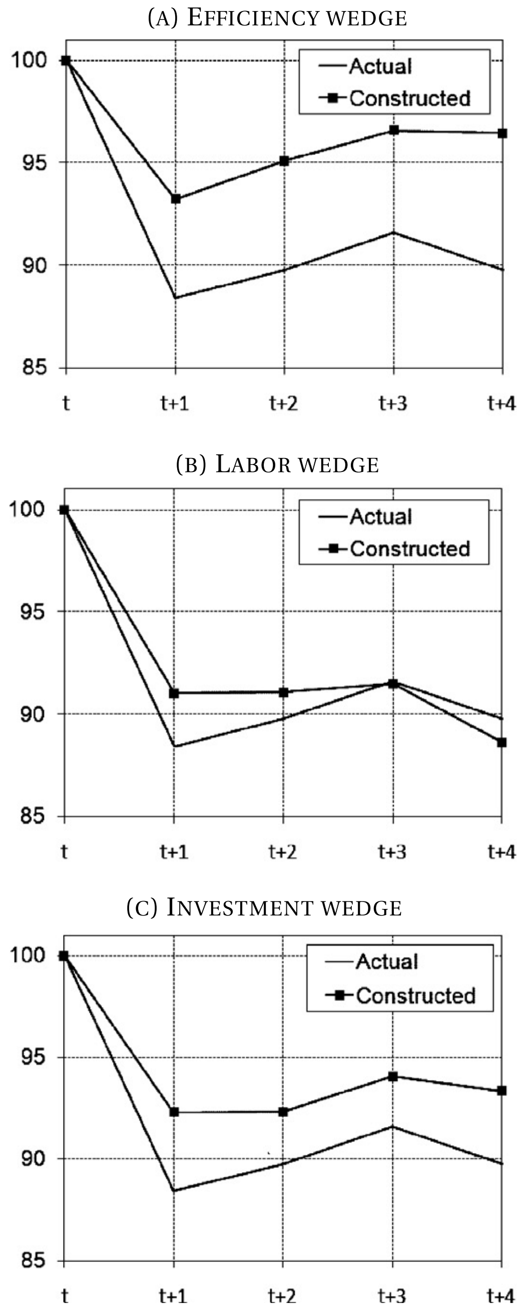

Fig. 2. Predicted paths of output using the model with all the wedges and the model with one wedge holding fixed at its pre-crisis level: Time t denotes the pre-crisis year for the Korean crisis episode.

Wedges, crisis severity and recoveries When we turn to the contributions of the different wedges to crises, the most obvious result is the dominance of the efficiency wedge in practically all episodes. On average, it explains about 60 percent of the output drop in the crisis year. The labor wedge comes second, with an average contribution to the drop of 20 percent, and the investment wedge comes third, at 14 percent. This is in line with the findings of previous BCA studies. What is more novel is the finding that, once more, Asian crises appear to be different from the rest. Specifically, the order of importance of the labor and investment wedges is reversed, i.e., in Asian crises the investment wedge appears to matter more than the labor wedge. To evaluate the significance of this observation, in Panel B of Table 5, we regress the contributions of each wedge on the previously defined Asian dummy variable. While the effect of the Asian dummy on the contributions of the efficiency and labor wedges are not significant, the coefficient estimate for the effect on the Asian dummy on the contribution of the investment wedge is 0.286, which is quite large and statistically significant. Moreover, when we run the outlier-robust regression *rreg*, coefficient significance increases substantially, as the p-value drops from 0.052 to 0.004.

Table 3
Contributions of wedges to output drops.

Country	Pre-crisis year	Contribution (%) of each wedge		
		Efficiency wedge	Labor wedge	Investment wedge
Argentina	1980	74.93	16.17	5.19
	1984	77.34	12.12	11.28
	1988	76.03	5.70	16.99
	1994	20.98	112.78	−6.12
	2001	48.88	58.48	−2.54
Brazil	1987	155.39	43.00	−74.67
	1991	40.12	54.99	−7.53
	1998	59.06	15.24	7.96
Chile	1981	31.11	56.65	−3.77
	1998	51.52	16.75	55.69
Finland	1990	50.27	18.08	15.29
Indonesia	1997	72.36	−15.98	37.88
Israel	1983	84.68	−27.21	77.00
Korea	1997	41.61	22.43	33.46
Malaysia	1997	75.02	−15.26	43.01
Mexico	1981	78.48	−18.21	29.91
	1994	64.10	2.82	−34.42
Philippines	1983	74.29	8.92	29.52
	1997	−26.33	121.09	15.67
Sweden	1991	11.98	50.98	20.46
Thailand	1997	72.43	−33.93	51.87
Turkey	1993	105.36	−1.66	−7.46
	2000	91.02	−5.61	8.31
Average		62.20	21.67	14.04

In sum, Asian crises appear to be more investment-driven. To graphically illustrate this, in Fig. 3 we compare a fairly typical non-Asian crisis, Brazil in 1987, to a fairly typical Asian crisis, Indonesia in 1997. In the graph, it is clear that the contribution of the investment wedge is greater in the latter. While we deliberately chose two cases for illustrative purposes, as the regression shows, the message from the comparison holds in general.

We next examine the relationship between the contributions of wedges and crisis severity. In Panel C of Table 5, we report the corresponding regression results, for the full sample and for the Asian subsample. In the full sample, results are insignificant, although the negative relationship between severity and the labor wedge's contribution is not far from significance (the p-value is 0.115). In the Asian subsample, however, the negative association between the labor wedge's contribution and severity, as well as the positive association between the contributions of the efficiency and investment wedges and severity are all statistically significant. We also find that the labor wedge is also more likely to 'bounce back' than the other two. When we regress a wedge's contribution to recovery on its contribution to the drop (see Panel D), the resulting coefficient for the labor wedge is positive and very close to significance with a p-value of 0.101.[8] On the other hand, the corresponding coefficients for the efficiency and investment wedges are far from significance. Results are similar when we restrict attention to the Asian subsample and when we correct for outliers.

Panel E, the last in Table 5, is an analog of Panel C for recoveries.[9] The contributions of the wedges—as defined by $\varkappa_{i,t+1}(w)$—correlate with the size of the recovery, measured as $y_{i,t+4} - y_{i,t+1}$ as follows. The contributions of the efficiency and investment wedges are both significantly positively correlated with the size of recoveries, while the contribution of the labor wedge has no significant association with the size of the recovery. This pattern, however, does not hold when we restrict attention to the Asian subsample, in which case all three coefficients are statistically null. Adjusting for outliers does not qualitatively change these results.[10]

Other correlates In addition to our analysis of severity and recoveries, and the distinction between Asian and non-Asian crises, we have examined the degree of association between wedges and a variety of variable, such as banking crises, rates of inflation, the decade in which the crisis occurred, and others. We found no significant associations between these other correlates and measured wedges.

Among the hypotheses that we considered, we were especially intrigued by the possibility of a link between the investment wedge and banking crises. Using the database compiled by Laeven and Valencia (2008), and supplementing it with

[8] Both in this case and when we regress severity on the labor wedge's contribution, the coefficients are not quite significant. Nevertheless, we have decided not to dismiss these results as null, since the p-values are very close to 0.1, and both coefficients become significant when we allow for variable capital utilization. (See the corresponding Appendix at the RED website.)

[9] We have omitted the analog of Panel B for recoveries, i.e., regressions of the contributions of each wedge to recovery on the Asian dummy, because all coefficients are clearly insignificant.

[10] In the VCU Appendix, we examine the robustness of these correlations, and find that, along these dimensions, the model with VCU yields results that are very similar to the baseline results described herein.

Table 4
Role of wedges during post-crisis years.

Country	Pre-crisis year	Recovery				Data minus model		
		Data (A)	Model without efficiency wedge (B)	Model without labor wedge (C)	Model without investment wedge (D)	$\varkappa_{i,t+1}$ (Efficiency) [= (A) − (B)]	$\varkappa_{i,t+1}$ (Labor) [= (A) − (C)]	$\varkappa_{i,t+1}$ (Investment) [= (A) − (D)]
Argentina	1980	−1.63	−0.13	−0.12	−1.44	−1.50	−1.75	−0.19
	1984	2.72	1.00	0.50	2.99	1.72	2.23	−0.27
	1988	9.89	−1.05	5.10	12.01	10.94	4.79	−2.12
	1994	11.82	5.00	7.85	11.47	6.82	3.97	0.35
	2001	21.24	2.12	23.98	16.04	19.12	−2.74	5.19
Brazil	1987	−1.43	3.72	−1.85	−2.30	−5.16	0.41	0.87
	1991	7.51	1.95	8.49	7.46	5.56	−0.97	0.05
	1998	2.30	5.35	−1.51	2.59	−3.04	3.81	−0.29
Chile	1981	−6.95	1.75	−12.62	−5.26	−8.70	5.67	−1.69
	1998	0.45	0.26	1.10	−0.36	0.19	−0.65	0.81
Finland	1990	−8.49	−11.48	−5.68	−3.06	2.99	−2.81	−5.43
Indonesia	1997	−1.75	−5.71	0.76	−3.82	3.96	−2.51	2.07
Israel	1983	8.52	0.51	6.93	10.65	8.01	1.59	−2.13
Korea	1997	1.61	3.46	−2.15	1.31	−1.85	3.76	0.30
Malaysia	1997	−3.11	−4.35	−4.07	−0.40	1.25	0.96	−2.71
Mexico	1981	−7.31	−3.54	−9.64	−2.02	−3.78	2.33	−5.29
	1994	7.50	2.87	7.79	6.34	4.63	−0.29	1.16
Philippines	1983	−6.60	−0.34	−10.35	−3.71	−6.26	3.75	−2.89
	1997	6.33	5.00	1.28	6.99	1.33	5.05	−0.66
Sweden	1991	0.70	−6.37	5.19	2.33	7.07	−4.49	−1.63
Thailand	1997	−3.92	−16.01	5.27	−3.81	12.08	−9.19	−0.11
Turkey	1993	9.23	−1.37	14.17	8.08	10.60	−4.94	1.15
	2000	9.14	−2.58	15.43	5.79	11.72	−6.30	3.35
Average		2.51	−0.87	2.44	2.95	3.38	0.07	−0.44

Note. The size of recovery in data is measured as $(y_{i,t+4} - y_{i,t+1})$.

Table 5
Correlating wedges and observables.

(A) Severity regressed on Asian dummy

	Output drop	Recovery	Drop minus recovery
Asia	5.110**	−5.076	10.186**
	(2.169)	(3.420)	(3.862)
p-value	0.028	0.153	0.015
Observations	23	23	23

(B) Contribution of each wedge regressed on Asian dummy

	Efficiency wedge	Labor wedge	Investment wedge
Asia	−0.143	−0.096	0.287*
	(0.169)	(0.194)	(0.139)
p-value	0.405	0.624	0.052
Observations	23	23	23

(C) Size of the output drop regressed on contribution of each wedge

	Output drop (all crises)			Output drop (Asian crises)		
Efficiency wedge	1.237			11.083*		
	(3.078)			(4.477)		
p-value	0.692			0.069		
Labor wedge		−4.231			−8.87**	
		(2.573)			(2.58)	
p-value		0.115			0.026	
Investment wedge			2.511			36.883*
			(3.439)			(14.107)
p-value			0.473			0.059
Observations	23	23	23	6	6	6

(D) Contribution to recovery regressed on contribution to drop

	Contribution to recovery		
	Efficiency	Labor	Investment
Contribution to drop: Efficiency	3.587		
	(4.146)		
p-value	0.397		
Contribution to drop: Labor		3.483	
		(2.029)	
p-value		0.101	
Contribution to drop: Investment			1.599
			(1.654)
p-value			0.345
Observations	23	23	23

(E) Size of the recovery regressed on contribution of each wedge

	Recovery (all crises)			Recovery (Asian crises)		
Efficiency wedge	0.787***			0.008		
	(0.161)			(0.373)		
p-value	0.000			0.983		
Labor wedge		−0.102			0.366	
		(0.405)			(0.384)	
p-value		0.804			0.396	
Investment wedge			2.029***			0.877
			(0.493)			(1.132)
p-value			0.000			0.482
Observations	23	23	23	6	6	6

Note. In all panels, each column denotes a different dependent variable, which is regressed on a single independent variable and an intercept. Standard errors are reported in parentheses below the corresponding parameter estimates. Asterisks *, **, and *** indicate 10%, 5%, and 1% statistical significance, respectively.

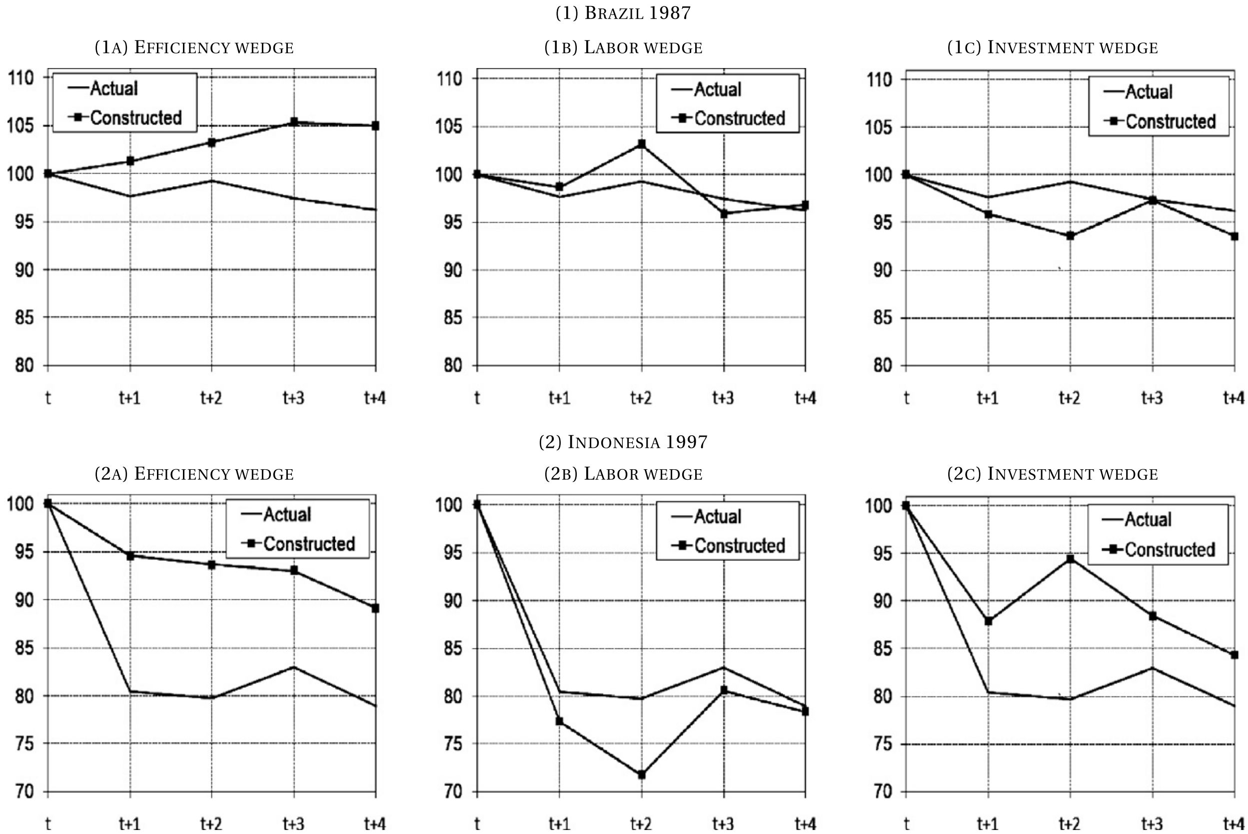

Fig. 3. Two illustrative examples.

information from Reinhart and Rogoff (2009), we obtained information, for most cases in our sample, on the fraction of nonperforming loans (NPLs) at the peak of the crisis, and the fraction of all banks closed. This information, along with some qualitative comments about banking crises is summarized in Table 6. As a further measure of banking distress, we also consider the drop in bank credit to the private sector. While the credit series from the World Bank (see the data description above) is available as a percentage of GDP, multiplying the series by nominal GDP, and deflating using the CPI, we construct a series for the flow of real credit from the banking system to the private sector.

Interestingly, the contribution of the investment wedge to the output drop is negatively correlated with all six measures of banking distress, i.e., with the share of NPLs, the share of banks closed, and the drop of credit between years t and $t+1$, t and $t+2$, t and $t+3$, or t and $t+4$. At the same time, however, the p-values associated with these correlations (between 0.2 and 0.4) are all much higher than the threshold for statistical significance. On the other hand, as we will see in the next section, the Asian dummy variable is more closely associated with our measures of banking and financial distress. Moreover, this finding—together with our other findings regarding Asia, crisis severity, and the investment wedge—can be interpreted through the lens of existing models.

5. Discussion: Asian finance, investment, and crises

Our empirical findings single out Asian crises as being deeper and more investment-driven than crises in other regions. In this section, we interpret these findings from the point of view of existing theories of Asian financial systems, and examine whether further predictions of the theories are validated by our data.

Perhaps the most well-known descriptions of Asian finance are the qualitative discussions of *crony capitalism* in the aftermath of the Asian crisis of 1997/98. Observers such as Krugman (1998) pointed to deficient institutions—specifically problems in corporate governance, poor state of competition, and close firm–bank–government relationships—as causes of the crisis. In a similar vein, Cargill and Parker (2002), have argued that, compared to their Western counterparts, Asian credit flows are primarily driven by long-term relationships rather than short-term profitability.[11] Credit is allocated preferentially

[11] It is interesting to note that, prior to the 1997/1998 crisis, this was often praised as a virtue, which allowed Asian firms to make investment decisions for the long run. By contrast, Western firms were criticized for myopically focusing on each quarter's earnings announcement and its effect on frantic stock markets.

Table 6
Summary of banking crises.

Country	Crisis year	Share of NPLs at peak (%)	Banks closed (%)	Brief summary
Argentina	1980	9	9.8	The failure of a large private bank (Banco de Intercambio Regional) led to runs on three other banks. Eventually, more than 70 institutions—16% of commercial bank assets and 35% of finance company assets—were liquidated or subjected to central bank intervention.
	1985	30	N/A	In early May, the government closed a large bank, leading to large runs, which led the government to freeze dollar deposits on May 19.
	1989	27	15.8	Nonperforming assets accounted for 27% of aggregate portfolios and 37% of state banks' portfolios. Failed banks held 40% of financial system assets.
	1995	17	2.4	The Mexican devaluation led to a run on the banks, which resulted in an 18% decline in deposits between December and March. 8 banks suspended operations, and 3 banks collapsed. Through the end of 1997, 63 of 205 banking institutions were closed or merged.
	2001	20.1	0	In March 2001, a bank run started due to a lack of public confidence in government policy actions. In late November 2001, many banks were on the verge of collapsing, and partial withdrawal restrictions were imposed (*corralito*) and fixed term deposits (CDs) were reprogrammed to stop to outflows from banks (*corralon*). In December 2002, the corralito was lifted. In January 2003, one bank was closed, 3 banks were nationalized, and many others were reduced in size.
Brazil	1985	N/A	0	3 large banks (Comind, Maison Nave, and Auxiliar) were taken over by the government.
	1990	16	0	Deposits were converted to bonds. Liquidity assistance to public financial institutions.
	1994–1996	15	N/A	In 1994, 17 small banks were liquidated, 3 private banks were intervened, and 8 state banks were placed under administration. The Central Bank intervened in or put under temporary administration 43 financial institutions and banking system nonperforming loans reached 15% by the end of 1997. Private banks returned to profitability in 1998, but public banks did not begin to recover until 1999.
Chile	1980	35.6	13.1	3 banks began to lose deposits; interventions began 2 month later. Interventions occurred in 4 banks and 4 nonbank financial institutions, accounting for 33% of outstanding loans. In 1983, there were 7 more bank interventions and one *financiera*, accounting for 45% of financial system assets. By the end of 1983, 19% of loans were nonperforming.
	1998	1.44	0	N/A
Finland	1991–1994	13	0	A large bank (Skopbank) collapsed on September 19 and was intervened. Savings banks were badly affected; the government took control of 3 banks that together accounted for 31% of system deposits.
Indonesia	1997–2002	35.5	27.7	Through May 2002, Bank Indonesia closed 70 banks and nationalized 13 out of 237. Nonperforming loans were 65–75% of total loans at the peak of the crisis and fell to about 12% in February 2002.
Israel	1983	N/A	0	Stocks of the 4 largest banks collapsed and were nationalized by the state.

(*continued on next page*)

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Table 6 (*continued*)

Country	Crisis year	Share of NPLs at peak (%)	Banks closed (%)	Brief summary
Korea	1997	35	37.3	Through May 2002, 5 banks were forced to exit the market through a "purchase and assumption formula", 303 financial institutions (215 of them credit unions) shut down, and 4 banks were nationalized. Banking system nonperforming loans peaked between 30 and 40% and fell to about 3% by March 2002.
Malaysia	1997	30	0	The finance company sector was restructured, and the number of finance institutions was reduced from 39 to 10 through mergers. 2 finance companies were taken over by the Central Bank, including the largest independent finance company. 2 banks—accounting for 14% of finance system assets were deemed insolvent and were to be merged with other banks. Nonperforming loans peaked between 25 and 35% of banking system assets but fell to 10.8% by March 2002.
Mexico	1981–1982	N/A	0	There was capital flight. The government responded by nationalizing the private banking system.
	1994–1997	18.9	0	In 1994, 9 banks were intervened and 11 participated in the loan/purchase programs of 34 commercial banks. The 9 banks accounted for 19% of financial system assets and were deemed insolvent. 1% of bank assets were owned by foreigners, and by 1998, 18% of bank assets were held by foreign banks.
Philippines	1981–1987	19	0	The commercial paper market collapsed, triggering bank runs and the failure of nonbank financial institutions and thrift banks. There were problems in two public banks accounting for 50% of banking system assets, 6 private banks accounting for 12% of banking system assets, 32 thrifts accounting for 53% of thrifts banking assets, and 128 rural banks.
	1997–1998	20	2.6	1 commercial bank, 7 of 88 thrifts, and 40 of 750 rural banks were placed under receivership. Banking system nonperforming loans reached 12% by November 1998 and were expected to reach 20% in 1999.
Sweden	1991–1994	13	0	The Swedish government rescued Nordbanken, the second largest bank. Nordbanken and Gota bank, with 22% of banking system assets, were insolvent. Sparbanken Foresta, accounting for 24% of banking system assets, intervened. 5 of the 6 largest banks, accounting for over 70% banking system assets, experienced difficulties.
Thailand	1996	33	2.4	As of May 2002, the Bank of Thailand shut down 59 of 91 financial companies (13% of financial system assets and 72% of finance company assets) and 1 of 15 domestic banks and nationalized 4 banks. A publicly owned assets management company held 29.7% of financial system assets as of March 2002. Nonperforming loans peaked at 33% of total loans and were reduced to 10.3% of total loans in February 2002.
Turkey	1994	4.1	0	3 banks failed in April.
	2000	27.6	15	2 banks closed, 19 banks have been taken over by the Savings Deposit Insurance Fund.

Sources: Laeven and Valencia (2008), Reinhart and Rogoff (2009).

to large borrowers, protected by banks and the government. Asian financial systems also differ from Western ones in their greater reluctance to impose bankruptcy, especially on large firms. Moreover, Asian financial systems are heavily bank-based, with bond markets having little importance.

Japan is widely cited as the country that set the blueprint for the Asian model of capitalism. The economic landscape in Japan is dominated by large business conglomerates called *keiretsu*, which include banks and large corporations operating across multiple industries. Cargill and Parker (2002) and Singh (1999) coincide in their assessment that many other Asian countries, including the five in our sample, have followed the Asian/Japanese model to varying degrees. This is attributed mostly to deliberate efforts to emulate Japan's economic success in the post-war decades.[12] Institutional similarities are most pronounced in South Korea, whose *chaebol* conglomerates are often compared to the Japanese *keiretsu*. According to Singh (1999), Malaysia, Indonesia and Thailand have also made explicit efforts to replicate the success of Japan and South Korea, and thus have adopted similar institutions. Asian practices have been less influential in the Philippines, a country whose singularity in the region is often attributed to its long history as a Spanish colony.[13] This description is consistent with the fact that, in our data, the Philippines does not conform to the patterns that we observe in other East Asian countries. There are two Philippine crises in our sample, both with single-digit output drops, instead of one with a double-digit drop. Moreover, the Philippine 1997 crisis was much more labor-driven than investment-driven. Regarding Japan, this description is also consistent with Chakraborty's (2009) findings that business cycle fluctuations in Japan tend to be driven by the efficiency and investment wedges, with the labor wedge playing a minor role.

Cargill and Parker (2002) go beyond qualitative description and formalize some of these ideas. In their model, an Asian and a Western financial systems are different because the former subsidizes unproductive firms, whereas the latter liquidates them. In simulations, the Asian system generates higher rates of growth and investment in initial stages. This prediction of the model also fits our data well. Rates of investment as a percentage of GDP can be observed in Fig. 4. With the exception of the Philippines, all Asian countries in our sample reach pre-crisis investment rates in the vicinity of 40%, while non-Asian countries typically have much lower pre-crisis investment rates of 30% or less. On the other hand, the model also predicts that, because it inhibits creative destruction, the Asian system is bound to deliver slower long-run growth than the Western system. Moreover, subsidization of failing firms creates a backlog of nonperforming loans. With a large stock of bad loans, if reform or another shock triggers a crisis, the model generates a contraction of output and investment that is extremely deep and persistent. These predictions are in line with our results.

In order to confirm additional features of the model, in Table 7, Panel A, we regress each of the six measures of financial and banking distress previously described on the Asian dummy variable. Consistently with the model, the share of nonperforming loans as a fraction of total loans is significantly higher in Asian crises than in the rest of the sample. The Asian dummy also correlates positively with our other measures of banking distress, i.e., the fraction of banks closed, and the percentage drops in real bank credit to the private sector between years t and $t+1$, t and $t+2$, t and $t+3$, and t and $t+4$. The p-values associated with these regression coefficients, however, range between 0.288 and 0.107, and thus fail to clear the 0.1 significance threshold. When we control for outliers using the robust regression routine, the positive link between Asia and nonperforming loans remains significant, and two measures that were previously close to significance, the ratio of banks closed and the credit drop from t to $t+4$, become significant.

As a further test, we examine the empirical literature on institutional features of Asian countries. In particular, we follow Johnson et al. (2000), who develop a series of measures of corporate governance aimed at capturing some aspects of *crony capitalism*. In Table 7, Panel B, we show two different variables, enforceable minority shareholder rights and anti-directors rights. As explained by the authors, the enforceable minority shareholder rights index tries to capture the extent of shareholder rights in practice. The index runs from 1 to 5, with a higher score indicating better treatment of minority shareholders. The "anti-director" rights index is the *de jure* rights of shareholders, and ranges from 0 to 6 with a higher score indicating better protection for minority shareholders. For 13 countries in our sample, both indexes are not available for Finland and Sweden, and we are left with 11 countries. We find that Asian crises have a significantly lower value of the enforceable minority shareholder rights index, indicating worse treatment of minority shareholders. The anti-directors rights index is also lower for Asian crises, but not significantly. We also examined other measures developed by Johnson et al. (2000), such as creditor rights, which were not significantly different for Asian versus non-Asian countries.

6. Conclusion

In this paper, we apply the Business Cycle Accounting (BCA) methodology developed by Chari et al. (2007) to the study of output drops and subsequent recoveries in a sample of 23 international financial crises. Not surprisingly, the efficiency wedge is the most important wedge in most cases, followed in this order, by the labor and investment wedges. However, we also find that the importance of the labor and investment wedges varies widely across episodes. In particular, Asian crises tend to be driven primarily by the efficiency and investment wedges, whereas European and Latin American crises

12 According to Cargill and Parker (2002), the presence of Japanese institutions in East Asia is also a legacy of Japanese occupation of Korea from 1910 to 1945, and of other countries during World War II.

13 Nelson (2007) argues that the long-term economic record of the Philippines is more similar to that of Latin American countries such as Peru than to its neighbors in the region.

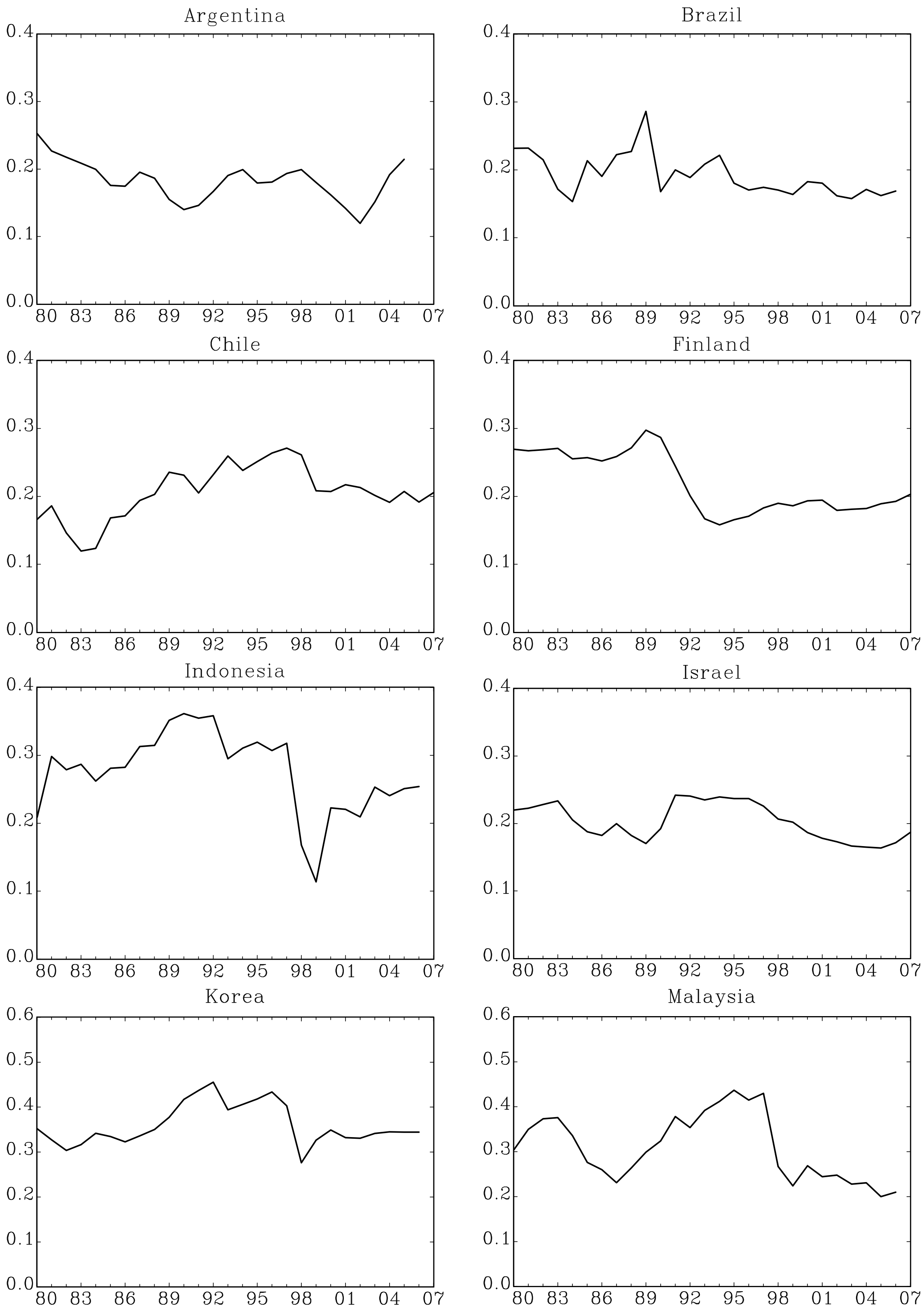

Fig. 4. Investment rate (measured as the ratio of investment to output).

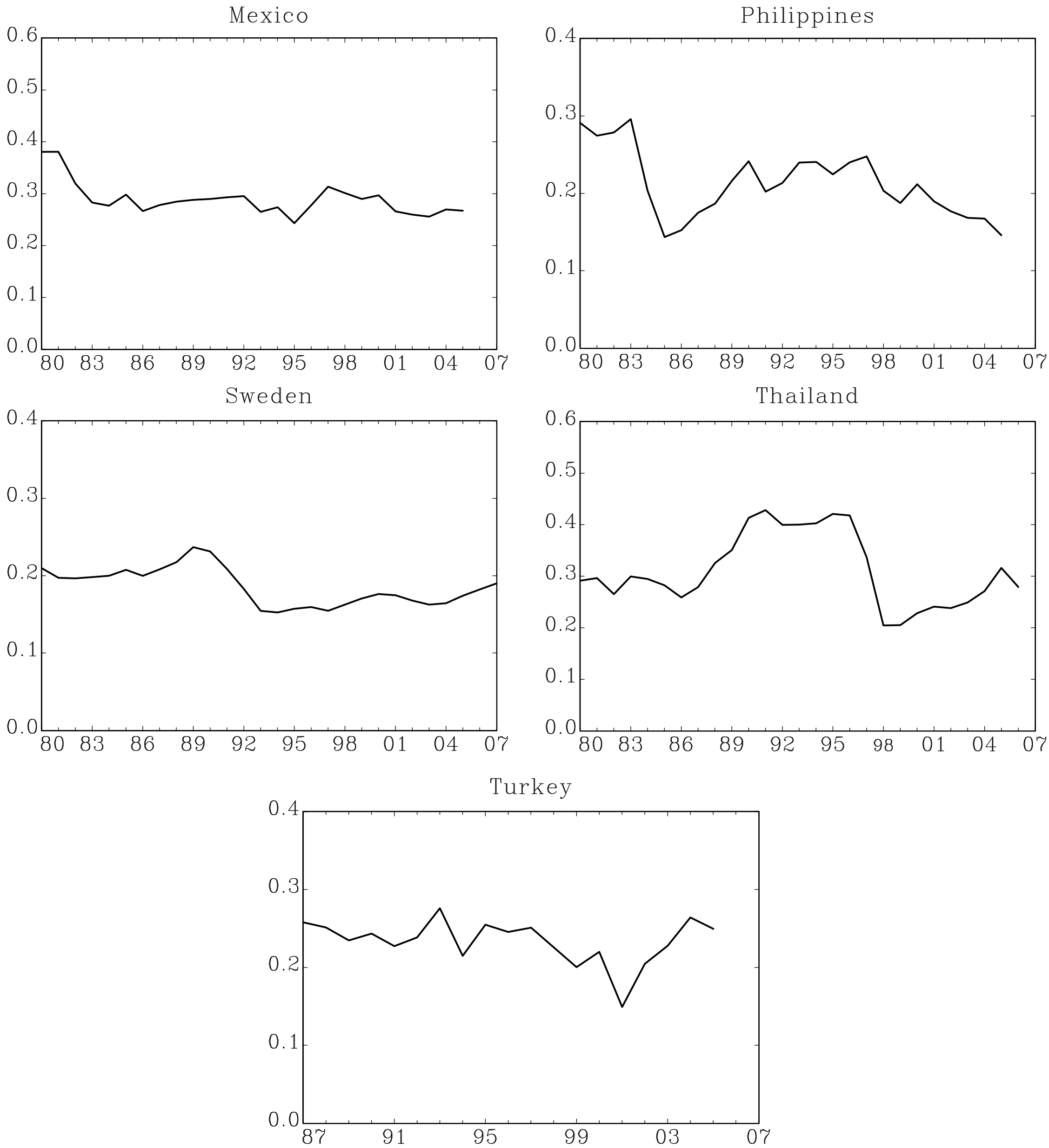

Fig. 4. (*continued*)

are primarily driven by the efficiency and labor wedges. Moreover, Asian crises tend be more severe, featuring larger drops in detrended output, and a failure to narrow the gap with the pre-crisis trend in post-crisis years.

The differences between Asian countries and the rest uncovered by the BCA procedure are in line with the findings of studies of Asian financial systems, which describe them as less reliant on market mechanisms and more reluctant to impose bankruptcy than Western systems. In Cargill and Parker's (2002) simulations, economies that subsidize insolvent firms to avoid bankruptcy initially invest more and grow faster than economies that are less averse to liquidating inefficient firms. Long-run growth, however, is slower because technology adoption is hampered by the absence of creative destruction. Moreover, because subsidization of low-quality firms generates a backlog of nonperforming loans, when crises do occur, they are far more severe. The countries in our sample conform to this description remarkably well, with Asian countries having higher pre-crisis rates of investment and growth, a greater decline in investment during the crisis, failure to narrow the gap with the pre-crisis trend, and significantly higher ratios of nonperforming loans to total loans.

Table 7
Credit and corporate governance variables.

(A) Credit variables

	NPLs	Share of banks closed	Credit drop from t to			
			$t+1$	$t+2$	$t+3$	$t+4$
Asia	0.106**	0.079	0.223	0.285	0.271	0.258
	(0.044)	(0.048)	(0.156)	(0.261)	(0.160)	(0.157)
p-value	0.029	0.117	0.169	0.288	0.107	0.116
Observations	20	21	22	22	22	22

(B) Corporate governance variables

	Enforceable minority shareholder rights	Anti-directors rights
Asia	−1.117**	−0.400
	(0.404)	(0.733)
p-value	0.022	0.599
Observations	11	11

Note. In all panels, each column denotes a different dependent variable, which is regressed on a single independent variable and an intercept. The corporate governance variables are from Johnson et al. (2000). The enforceable minority shareholder rights index ranges from 1 to 5 with a higher score indicating better treatment for minority shareholders. The "anti-director" rights index ranges from 0 to 6 with a higher score indicating better protection for minority shareholders. Standard errors are reported in parentheses below the corresponding parameter estimates. Asterisks *, **, and *** indicate 10%, 5%, and 1% statistical significance, respectively.

Supplementary material

The online version of this article contains additional supplementary material.
Please visit http://dx.doi.org/10.1016/j.red.2012.10.003.

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