



ADB Working Paper Series

**Banking Crises and
“Japanization”: Origins and
Implications**

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No. 430
July 2013

Asian Development Bank Institute

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Suggested citation:

Kawai, M., and P. Morgan. 2013. Banking Crises and "Japanization": Origins and Implications. ADBI Working Paper 430. Tokyo: Asian Development Bank Institute. Available: <http://www.adbi.org/working-paper/2013/07/29/5837.banking.crisis.japanization.origins.implications/>

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Abstract

Japan's "two lost decades" perhaps represent an extreme example of a weak recovery from a financial crisis, and are now referred to as "Japanization." More recently, widespread stagnation in advanced economies in the wake of the global financial crisis led to fears that Japanization might spread to other countries. This study examines the dimensions of Japanization—including low trend growth, debt deleveraging, deflation, and massive increases in government debt—and analyzes their possible causes—including inadequate macroeconomic policy responses, delayed banking sector restructuring, inadequate corporate investment, loss of industrial competitiveness, a slowdown in total factor productivity (TFP) growth due to excessive regulation and economic rigidities, and an aging society.

The study compares Japan's experience with three other groups that experienced banking crises in the 1990s—developed economies; emerging Asian economies and Latin American economies. Japan's experience is found to parallel most closely that of other Asian economies that experienced unusually high growth rates of gross domestic product (GDP) and credit before their crises. The study also develops an econometric model of long-term growth rates that uses measures of net investment, the share of the aged in the population, and occurrence of banking crises in addition to traditional explanatory variables. It finds that very low rates of consumer price index (CPI) inflation (or deflation) and net investment, the lack of openness to foreign direct investment, and an aged population explain much of Japan's slowdown.

JEL Classification: E20, E31, E51, F31, G01

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1. INTRODUCTION

Recent research has found that economic recoveries from banking crises tend to be weaker and more prolonged than those from traditional types of deep recessions (see for example IMF 2009). Japan's "two lost decades" perhaps represent an extreme example of this, and the experience has now passed into the lexicon as "Japanese-style stagnation" or "Japanization" for short.¹ A long period of economic stagnation during peace time is not new, particularly among developing countries—the "lost decade" of Latin America in the 1980s is just one example. But Japanization was a surprising phenomenon observed in a mature market economy where the authorities were supposed to have sufficient policy tools to tackle banking crises and manage the economy. It is characterized by a lack of nominal gross domestic product (GDP) growth; deflation in prices of goods, services, and assets; weak real economic activity; subdued private demand for credit; and a dramatic rise in government debt. Price deflation and a near-zero short-term interest rate led Japan to be a leader in experimenting with unconventional monetary policies such as quantitative easing.

Several factors may have contributed to Japanization, such as inadequate macroeconomic policy responses, delayed banking sector restructuring, inadequate corporate investment, loss of industrial competitiveness, a slowdown in total factor productivity (TFP) growth due to excessive regulation and economic rigidities, and an aging society. Understanding how and why Japanization took place is critical to avoiding similar, prolonged economic stagnation in post-banking crisis periods in other countries, such as the United States (US) and the euro area economies. For this purpose it would be useful to examine how other countries affected by banking crises—such as those in Organisation for Economic Co-operation and Development (OECD) countries, Asia, and Latin America—recovered from crises through the prism of Japan's post-crisis experience. This will help identify the features of crisis effects and policy lessons and avoid the kind of economic stagnation seen in Japan.

The paper is organized as follows. Section 2 reviews the features of Japan's long-term economic stagnation by looking at several macroeconomic variables over time and points out the factors that have likely contributed to the country's prolonged subperformance. Section 3 then assesses the experience of banking crises in other developed and emerging economies in comparison with Japan's and finds the extent to which Japan's post-crisis economic performance is an outlier from international comparative perspectives. Section 4 conducts econometric analysis to examine the determinants of the growth rate of per capita (or per worker) real GDP for an unbalanced panel data of more than 60 countries over the last two decades. The regression analysis focuses on the potential importance of price inflation (or deflation), capital accumulation, bank credit, a banking crisis, and other structural variables such as population aging. Finally, section 5 concludes by suggesting policy recommendations to help avoid long-term stagnation, particularly for the US and the euro area countries, which may also experience some symptoms of Japanization.

¹ As described in "After Five Years of Crisis, the Euro Area Risks Japanese-style Economic Stagnation," *The Economist*, 4 August 2012.

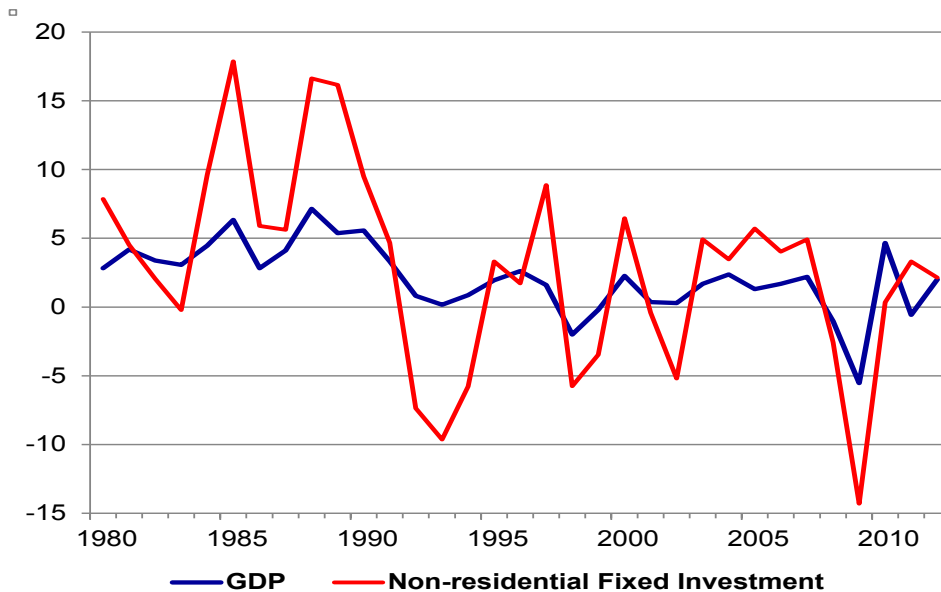
2. JAPAN'S "STAGNATION" EXPERIENCE

2.1 Features of "Japanization"

Macroeconomic performance

Reinhart and Rogoff (2009, 2010) compiled an exhaustive list of worldwide financial crises of various types. According to their classification, Japan's banking crisis dated from 1992 to 2001.² However, the slow-motion nature of the Japanese financial crisis makes it difficult to describe the process very precisely. Figure 1 shows that GDP growth hit a near-term peak in 1988 and fell steadily thereafter, hitting a trough in 1998. Stock and land prices peaked in December 1989 and September 1991, respectively, and then began a long period of decline in subsequent decades.

Figure 1: Japanese Real GDP and Capital Investment Growth (%), 1980–2012



Source: Cabinet Office, Government of Japan.

If one takes 1992 as the year of the onset of the Japanese banking crisis, the data show a clear break in the decades before and after this year. Table 1 illustrates that per worker real GDP, which gives a measure of labor productivity, had grown at 2.6% in the decade before the crisis, but declined sharply to 0.5% growth in the following decade. Moreover, there was no recovery in the succeeding decade, partly due to the effects of the sharp recession in 2009 following the Lehman Brothers shock. In this sense, the Japanese economy experienced "two lost decades." The growth rate of real GDP per working-age person (aged 15–64) did modestly better, especially in the most recent decade, reflecting a modest worsening in employment. The growth rate of per worker-hour real GDP also

² We use the data files from Reinhart's website, which are associated with Reinhart and Rogoff (2010), www.carmenreinhart.com/data/browse-by-topic/topics/7/ (accessed on 1 July 2013). In many cases, the crisis periods are different from those in Reinhart and Rogoff (2009), including those for Japan.

declined over time from 3.2% in 1982–91 to 0.8% in 2002–11 though it remained relatively high at 1.5% in 1992–2001. For reference, the Conference Board's *Total Economy Database* shows a rather milder rate of deterioration in Japan with per worker GDP growth slowing from 2.9% in 1982–91 to around 1% thereafter. This growth rate is much more in line with the OECD growth average. Moreover, the Conference Board data show substantially higher growth of output per worker-hour—closer to 2%—than the Japanese government data, also in line with the OECD average.³

Japan's Real Growth Experience (average annual growth rate, %), 1972–2011

Indicator	1972–1981	1982–1991	1992–2001	2002–2011
Japanese Government data				
Real GDP	4.3	4.0	0.6	0.1
Per capita real GDP	3.2	3.5	0.3	0.0
Per working-age (15–64) real GDP	3.4	3.1	0.6	0.6
Per worker real GDP	3.4	2.6	0.5	0.4
Per worker-hour real GDP	4.1	3.2	1.5	0.8
Conference Board data				
Real GDP	4.3	4.0	0.8	0.7
Per capita GDP	3.2	3.5	0.6	0.6
Per working age (15–64) real GDP	3.4	3.1	0.9	1.2
Per worker real GDP	3.4	2.9	0.9	1.0
Per worker-hour real GDP	3.8	3.5	1.9	1.7

Note: The Conference Board data for real GDP are measured in 1990 international dollars converted at Geary-Khamis (GK) purchasing power parities (PPPs).

Source: Cabinet Office, Government of Japan; OECD, Statistical database; Conference Board, *Total Economy Database*; and authors' estimates.

The main difference between the Conference Board data and the Japanese national accounts data is that the former uses Geary-Khamis (GK) dollars, which are adjusted for both inflation and purchasing power parity (PPP). This has the advantage of putting all countries' growth data in comparable units. The use of PPP price measures probably somewhat offsets the effects of the yen's appreciation during the period, and therefore is probably the major reason behind the higher growth estimate. Given that GK dollars are not yet widely used for international comparisons, we focus on the local currency-based or the World Bank's 2005 PPP-based real growth estimates, while bearing in mind that local-currency figures may overestimate, and PPP figures underestimate, the extent of Japan's growth slowdown.

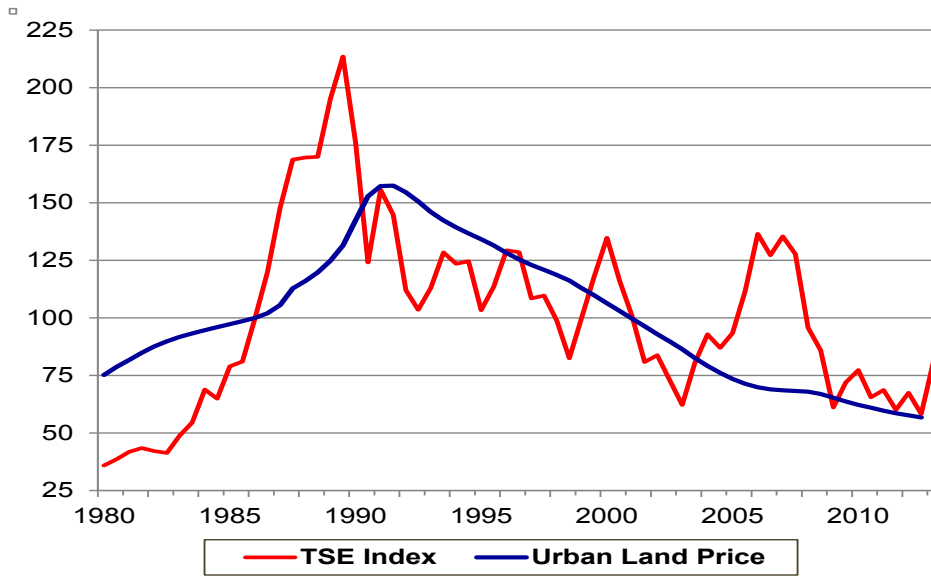
The Japanese banking crisis was a classic real-estate-led boom and bust, accompanied by a stock market boom-bust cycle. Figure 2 shows that the stock market peaked in December 1989, while land prices on an all-nation basis peaked over almost two years later in September 1991.⁴ Stock prices and land prices rose by almost 130% and 60% to

³ The Conference Board Total Economy Database is available at www.conference-board.org/data/economydatabase/ (accessed 1 July 2013).

⁴ One of the features of Japan's land boom was that the rise in commercial land prices during the bubble was higher than that of residential land prices, and the decline in commercial land prices in the post-bubble period was sharper than that of residential land prices.

their respective peaks from March 1986. In the subsequent 20 years, however, stock prices came down as a trend to the pre-1985 level, and land prices lost all of their gains between 1980 and 1991 and still have not hit bottom.⁵

**Figure 2: Stock Market and National Land Prices (March 1986 = 100),
1980–2013**



Source: Japan Real Estate Institute; and CEIC Database.

The boom was supported by a steady acceleration of bank loan growth during most of the 1980s, peaking at about 13% in 1987 (Figure 3). Lending growth slumped beginning in 1991, and slid steadily to around zero growth by 1994, where it stabilized until 1998. From 1998 through 2005, bank loans fell sharply due to the beginning of a systemic banking crisis, the Asian financial crisis of 1997–98, the US dot-com bubble collapse in 2000, and aggressive policies to write off bad debts and recapitalize banks. The fall in bank loans was a reflection of substantial deleveraging undertaken by commercial banks. Surprisingly, bank lending continued to contract when economic growth resumed in 2003–05, but it finally made a modest recovery in 2006–08, only to be hit by the Lehman shock in 2008. It began to recover again in 2011, but its level remains well below the peak of 1997.

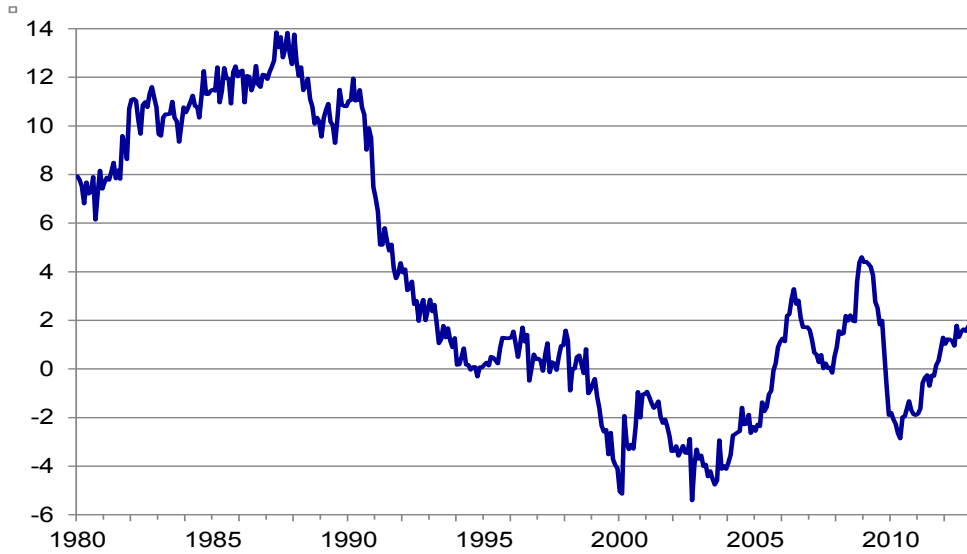
Features of Japanization

The most unique aspect of Japan's post-bubble experience has been the lack of growth of nominal GDP in yen terms. Figure 4 shows that nominal GDP rose, albeit slowly, throughout most of the 1990s and peaked in 1997, but has declined as a trend since then. As a consequence, nominal GDP in 2012 was 9% below its peak level in 1997. However, real GDP rose as a trend because of declines in the GDP deflator. The GDP deflator began to decline in 1994 and the decline has been particularly sharp since 1998. Both the

⁵ Following the introduction of so-called Abenomics (named after Prime Minister Shinzo Abe), stock prices regained their value to some extent, but land prices have yet to see a solid rise.

continuous fall of the GDP deflator for more than 15 years and the long-term stagnation of nominal GDP growth for more than 20 years are a remarkable phenomenon.

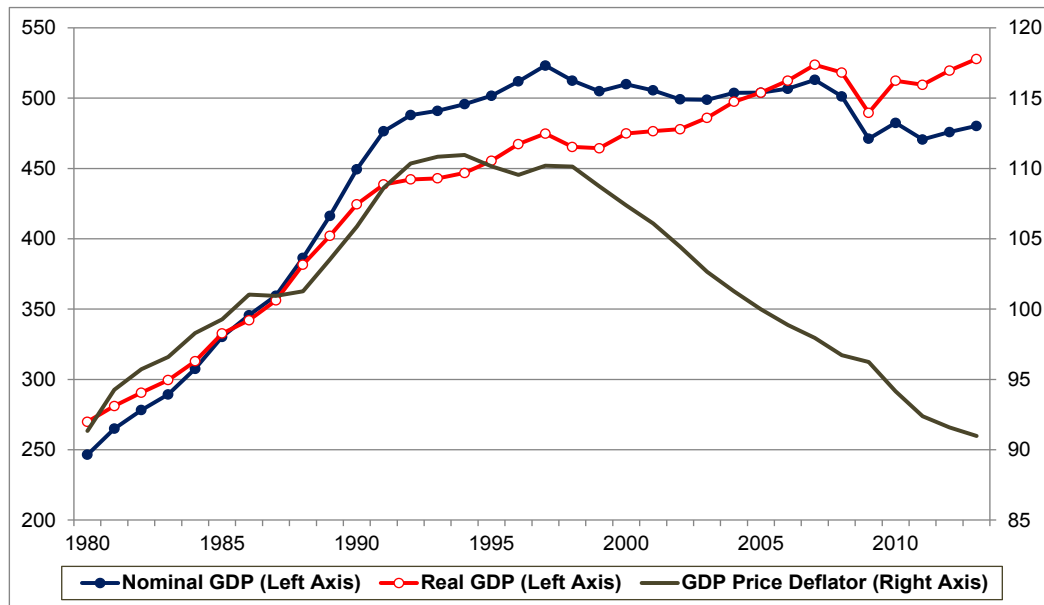
Figure 3: Growth Rates of Loans and Discounts of Domestically-Licensed Banks (%), 1980–2013



Note: Growth rates are year-on-year.

Source: CEIC Database.

Figure 4: Nominal and Real GDP (¥ trillion) and the GDP Deflator (2005 = 100), 1980–2013

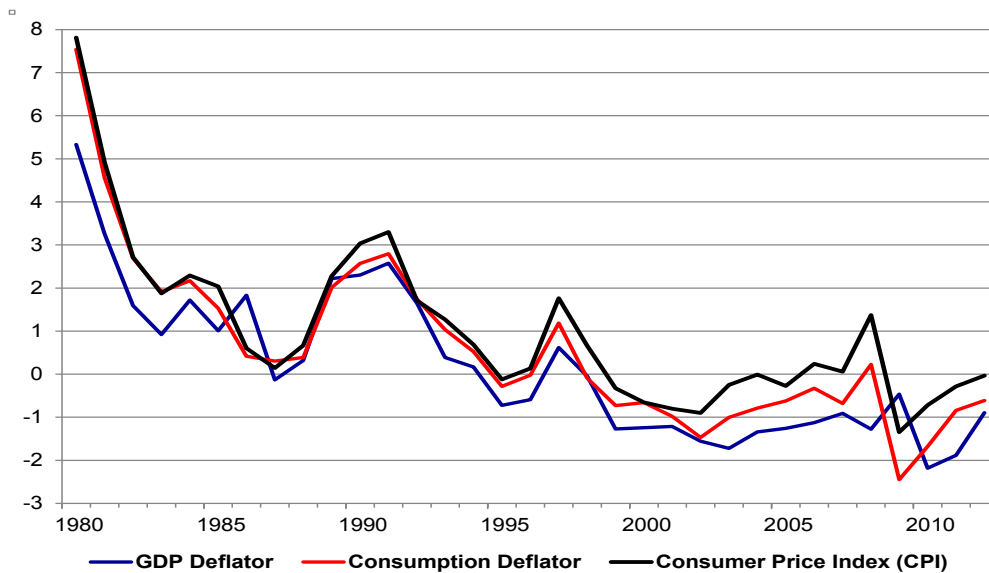


Note: Nominal GDP and real GDP are on the left axis, while the GDP deflator is on the right axis. Real GDP is at 2005 constant prices. Data for 2013 are International Monetary Fund (IMF) projections.

Source: IMF, World Economic Outlook database, April 2013.

The second feature of Japan’s post-bubble period has been the prolonged deflation of goods and services prices (see Figure 5). The GDP deflator has fallen 18% since its peak in 1993, mostly reflecting large declines in prices of exports and capital investment goods. The only exceptions were a blip in 1997 (due to a hike in the consumption tax rate from 3% to 5%) and a slight blip in 2008 (due to the global commodity price rise). The fall in the consumption deflator of the national accounts was also notable, down 12% since the end of 1994. In contrast, the decline of the consumer price index (CPI) has been much milder, down only 2% since the end of 1994, reflecting differences in methods of computation and the possible upward bias due to using fixed weights for different components. Although both consumer price indicators had shown improvement since 2002, they lost ground again after the Lehman shock in 2008.

Figure 5: Rates of Change in GDP Deflators and Consumer Prices (%), 1980–2012



Source: CEIC Database.

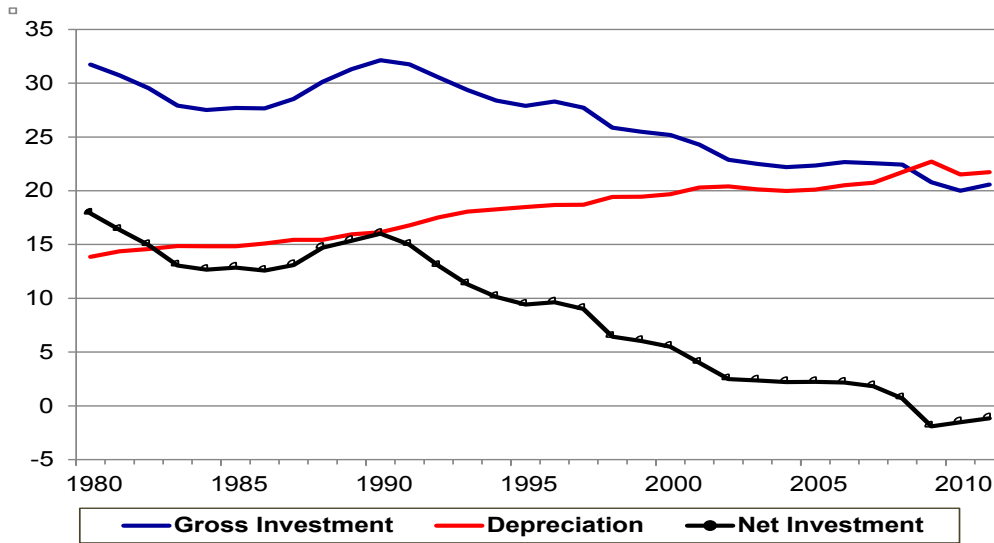
The third defining characteristic of Japan’s post-bubble experience has been the sharp slowdown of private capital investment, especially on a net basis after deducting for depreciation of capital stock. Figure 6 shows that the share of gross fixed investment in GDP declined gradually from a peak of 32% in 1990 to 20% in 2011. However, as depreciation of the capital stock rose steadily, net investment fell sharply as a share of GDP from more than 15% at the peak of the bubble to a negative value in the post-Lehman shock period. This slowdown in net investment and, thus, in capital accumulation likely made a significant contribution to the overall slowdown of GDP growth.⁶

The fourth defining feature of Japan’s post-bubble stagnation has been the fall of nominal interest rates to extremely low levels, essentially zero in the case of short-term interest

⁶ Other developed economies showed milder declines in net investment. The ratios of net investment to GDP for Germany, the US, and the UK fell from a range of 6%–9% in 2000 to about 3% in 2011. This points to a longer-term decline in growth rates in those countries as well. But Japan’s sharp economic decline since the eruption of the global financial crisis—including that in net disinvestment—stands out.

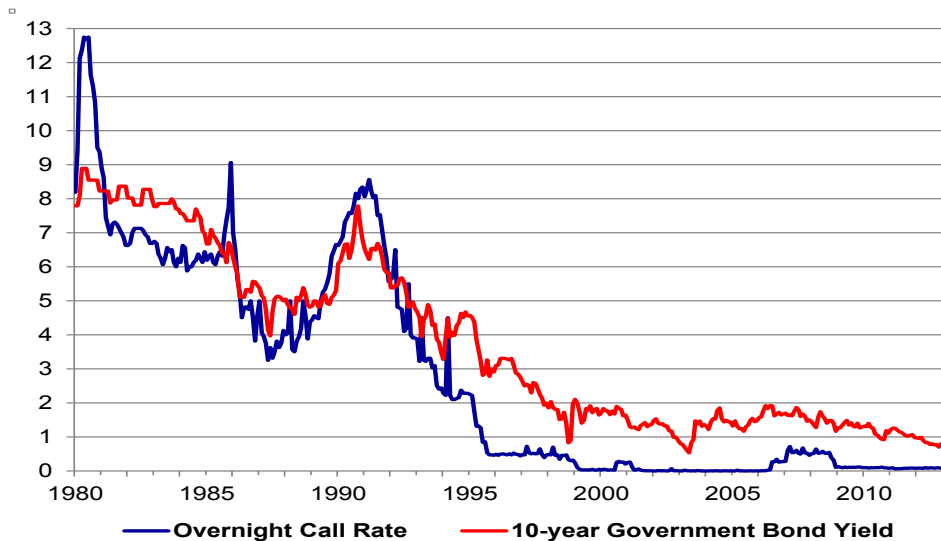
rates, reflecting the Bank of Japan’s (BOJ) efforts to combat price deflation (Figure 7). The overnight call rate, the BOJ’s normal operating target, has stayed close to zero since 1999, except for two ill-fated and temporary rate hike episodes in 2000 and 2007. The 10-year Japanese government bond (JGB) yield fell steadily from 1990 through 1998, then was somewhat range-bound until 2006, and most recently has been declining gradually, falling below 1% in 2012. The phenomenon of very low nominal interest rates has now spread to a number of developed economies, including the US, the United Kingdom (UK), and the euro area.

Figure 6: Gross and Net Investment and Capital Depreciation (% of GDP), 1980–2011



Source: Cabinet Office, Government of Japan; and CEIC Database.

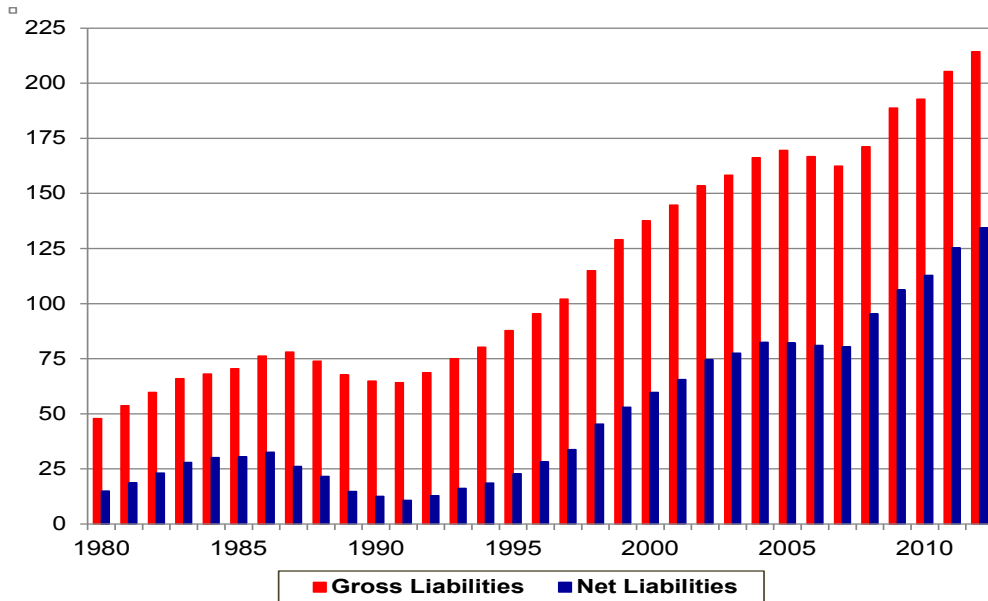
Figure 7: Japanese Interest Rates (%), 1980–2012



Source: CEIC Database.

The final major characteristic of Japan's stagnation has been the ballooning of government debt. Japan now has the dubious honor of having the highest levels of both gross debt and net debt as a percent of GDP among the OECD countries (Figure 8), although it has not suffered obviously for it. This sharp rise has been due to continuously large fiscal deficits as a result of declining tax revenues reflecting weak economic growth and of numerous large fiscal stimulus packages, as well as a steady rise in old-age-related social security spending (for pensions and health) reflecting the rapidly aging society.

Figure 8: Japanese Government Debt Levels (% of GDP), 1980–2012



Note: Data for 2012 are Organisation for Economic Cooperation and Development (OECD) projections.

Source: OECD, *Economic Outlook*, December 2012.

To summarize, the key aspects of Japanization appear to be a combination of a lack of growth in nominal GDP (due to prolonged weak real growth and outright deflation), sustained deleveraging of the private sector in the aftermath of the bursting of the bubble, a large increase in government debt, and a fall in nominal interest rates to near-zero levels. Although the US and a number of European countries have also experienced low real GDP growth, rising government debt, and low interest rates in the aftermath of the global financial crisis, none has experienced outright deflation or a lack of nominal GDP growth to any significant extent. In this sense, Japan's experience has been unique.

2.2 Possible Factors behind Japanization

Factors behind growth stagnation

Japan's poor economic performance in the post-bubble period can have several explanations, including:

- inadequate monetary policy responses, leading to persistent price deflation and yen appreciation;

- prolonged pace of deleveraging, leading to persistent asset price stagnation;
- slow reaction to banking sector problems in the form of regulatory forbearance and “zombie” financing;
- lack of structural reform resulting in excessive regulation, economic rigidities, limited openness, and inefficiency; and
- aging of the population.

The first factor is basically one of monetary policy, that is, the BOJ reacted too slowly and reluctantly to ease policy in the face of the collapse of the asset price bubble and the developing banking crisis in the early to mid-1990s. Ueda (2012) notes that the BOJ did not recognize the negative interaction between real economic and financial factors in its official report until late 1993. It was not until 1995 that the overnight call rate was lowered below 2% (Figure 7).

Inadequate monetary policy is clearly the primary reason behind outright deflation and a lack of nominal GDP growth throughout the 1990s and 2000s. Deflation likely stifled incentives for household consumption (as holding cash was more attractive) and for corporate investment (due to deflationary prospects). Nominal wages remained depressed, further discouraging household consumption. Deflation was also a driver of the persistently strong yen, particularly during 1990-95 and 1998-2000, having likely harmed the manufacturing sector.⁷ However, it is difficult to make a strong case for this in more recent post-Lehman shock years as the real effective yen rate was not especially strong.⁸ In addition, deflation did not help in halting the deleveraging process or the continuous declines in land prices. Essentially, deflation was either one of the primary factors behind stagnant economic activity or at least failed to provide a favorable economic environment for consumption and business investment.

The second factor is the process of deleveraging by commercial banks and indebted corporations. According to this view, commercial banks extended “excess” bank loans to the corporate sector with real estate as collateral during the asset-price-bubble period of the late 1980s. The collapse of the asset market exposed the large claims of banks on the corporate sector and the high debt of the corporate sector to banks, forcing both banks and corporations to accelerate deleveraging. This reinforced the declines in financial and real estate prices, further weakening economic activity. Thus, Corbett and Ito (2010) argued that the main reason for weak growth in the 1990s was the collapse of the financial and real estate bubble.

The third factor relates to the slow response to banking sector non-performing loans (NPLs) and the emerging banking crisis. It is widely recognized that the Japanese authorities’ initial policy was one of “forbearance,” i.e., allowing Japanese banks to carry NPLs on their balance sheets in the hopes that client companies would eventually recover. Thus, banks financed overdue loan payments, rather than lending to viable companies

⁷ Hamada and Okada (2009) argue that the yen’s estimated 78% over-valuation in real terms against the US dollar by 1995 exerted a large long-term depressing effect on the Japanese economy, which was only masked at times by favorable movements in the terms of trade, chiefly due to declines in energy prices.

⁸ Nonetheless, there is some evidence that the automobile sector—a large exporter in Japan—faced much more significant real effective yen appreciation in the late 2000s and the early 2010s.

willing to invest. This likely led to the development of inefficient "zombie" companies that contributed to excess capacity and price deflation while stifling investment by more productive companies.⁹ This phenomenon was analyzed by Hoshi and Kashyap (1999) and others. Many studies, including Sekine (1999) and Kasahara, Sawada, and Suzuki (2011), have also identified a link between banks' weak balance sheets and declines in investment spending during this period.¹⁰

Several underlying factors likely contributed to the slow response on the part of the financial authorities (Kawai 2005). One is the lack of an acute crisis—such as a currency crisis which would have prompted the authorities to respond quickly and decisively—due to the presence of large domestic savings and foreign exchange reserves, which provided substantial breathing room for policymakers but also caused a delay in action. Another is the sustained use of emergency fiscal policy packages, which maintained a minimum degree of aggregate demand and may have delayed decisive policy action. The financial authorities reacted decisively only after Japan faced a systemic banking crisis in 1997–98.

The fourth factor, structural rigidities, is not directly linked to the crisis, but can be another reason for slow growth, since they tend to inhibit the reallocation of resources to sectors with potentially higher productivity (see Box 1). These negative effects may have been exacerbated in periods of slow growth that likely started due to other factors. High regulation and barriers to entry are important examples of rigidity. Hoshi and Kashyap (2011) cite a number of studies finding a negative relationship between the degree of regulation and productivity growth. Many observers have noted that Japan's very low ratios of imports and the stock of inward foreign direct investment (FDI) to GDP could be a manifestation of the closed nature of the Japanese economy, which constrains growth.¹¹

The government of Prime Minister Shinzo Abe has taken up structural reform as the "third arrow" of its Abenomics program to restore Japanese economic growth and end deflation. A detailed program has yet to be formulated, but the government is focusing on industrial revitalization, strategic market creation (health, agriculture), and international partnerships. Most notably, the government has joined negotiations for the Trans-Pacific Partnership, the Japan-European Union Economic Partnership Agreement, and the Regional Comprehensive Economic Partnership. The Japanese agricultural sector is notoriously inefficient, so trade concessions in that sector could open the way for significant improvements in economic efficiency. However, it is too early to judge the results of this program.

A fifth possible factor, also structural, is the aging of society. This should not directly affect our measure of labor productivity, which is output per working-age (15–64 years old) person or per worker-hour, except to the extent that older workers remain in the labor

⁹ Hoshi and Kashyap (2011) cite research showing that the estimated share of assets of listed companies made up of "zombie" firms rose from about 3% in 1991 to 16% in 1996.

¹⁰ It is also recognized that the shift to a stricter regulatory regime following the recapitalization of Japanese banks in 1997 and 1998 had a short-run impact of weakening economic activity. Ueda (2012) notes that once banks had sufficient capital to write off their NPLs, their deleveraging became more aggressive, worsening the credit crunch. However, the bank recapitalization helped Japanese banks in bottoming out their loans in the 2000s and had paved the way toward recovery until 2008.

¹¹ In 2011, Japan's import-to-GDP ratio and stock-of-inward-FDI-to-GDP ratio were 14.5% and 3.9%, respectively. Those ratios ranked 167th out of 172 countries and 194th out of 198 countries, respectively.

market. However, aging could have a number of other possible impact channels, including lower savings, higher old-age-related expenditures, a possible loss of economic "dynamism" (a lack of development of new high-growth industries), and lower TFP growth. Declining savings could also raise the cost of capital, thereby reducing capital investment, although this has not been apparent yet.

Box 1: Brief History of Structural Reforms in Japan

Attempts to promote structural reform in Japan have a long history. Contrary to popular belief, some notable progress has been made, although much remains to be done. These attempts initially came from abroad, reflecting perceptions that structural features of Japan's economy tended to discourage imports and push up Japan's current account and trade surplus. At the macroeconomic level, numerous factors were perceived to contribute to a high level of savings relative to investment, including preferential taxation of savings and inadequate infrastructure investment. At the microeconomic level, excessive government regulation, burdensome import procedures, collusive market practices, closed "keiretsu" business networks, and high land prices were seen as contributing to low levels of imports and inward foreign direct investment (FDI). Although foreign reform pressures—called *gaiatsu*—were aimed primarily at trying to correct the trade balance, it was also argued that many such reforms would benefit Japanese consumers by lowering costs and increasing competition. After the Japanese financial crisis of the 1990s and the sharp slowdown in trend growth, calls for structural reforms to boost potential growth were taken up domestically as well.

Structural reform efforts had started before the collapse of the bubble. The Mayekawa Report (Mayekawa 1986) was perhaps the first Japanese call for extensive structural reforms since the economic reforms immediately after the Second World War. The report identified six major areas for policy changes to reduce current account balances: (1) expansion of domestic demand, including both consumption and infrastructure investment; (2) transformation of the industrial structure, including promotion of inward FDI; (3) promotion of manufactured imports and further improvements in market access; (4) international financial liberalization and stabilization of international currency values; (5) increased contribution to the global economy and international cooperation; and (6) fiscal and monetary policy support. However, there was no concerted move to act on these proposals, presumably because there was little domestic support or perceived need for reforms at the time.

In 1989, the US and Japanese governments started the Structural Impediments Initiative (SII), a series of discussions with Japan to address Japanese economic policies and business practices that the US claimed impeded US exports and investments. These included: Japan's high savings–low investment imbalance; the Japanese retail distribution system, particularly its Large-Retail Store Law that restricted entry by large-scale retailers; land use policies that inhibited market entry of new firms and kept land prices high; the keiretsu business conglomerates that restricted market entry; exclusionary business practices, such as the formation of cartels to limit competition; and discriminatory pricing practices.

The bilateral negotiations produced a number of tangible results, including a much expanded program of public works spending on infrastructure, a reduction in working hours of government employees, changes in the taxation of savings, and, most notably, substantial

revisions of the Large-Retail Stores Law, including shortening the approval process to 12 months, restraining local authorities from enacting their own, restrictive regulations, and exempting from the approval process new or expanded floor expansion up to 1,000 square meters for import sales (Cooper 1993).

The “Big Bang” reform of the financial sector beginning in 1996 under Prime Minister Ryutaro Hashimoto had an important effect of opening up the financial sector to greater competition. Measures included: introducing new investment trusts and over-the-counter sales of investment trusts by banks and other financial institutions; full liberalization of dealings in securities derivatives; promoting entry of banks, securities companies, and insurance companies into each other’s business; switching from the licensing system to a registration system for securities companies; liberalizing cross-border capital transactions and foreign exchange business; fully liberalizing brokerage commissions; abolishing the requirements to trade stocks only through stock exchanges; introducing stock exchanges for start-up companies; and improving disclosure systems and setting up fair trading rules (Lincoln and Litan 1998).

Facing long-term economic stagnation, Prime Minister Junichiro Koizumi focused on deregulation and structural reform comprising three parts: reforming the administrative system such as the postal saving system and various special semi-governmental corporations; decentralizing or transferring administrative power to local governments by reducing subsidies, reallocating local government block grants, and transferring taxation power to local government; and deregulating the employment, medical care, education, transportation and communication sectors (Teranishi 2009). In addition, Prime Minister Koizumi urged the Financial Services Agency to put greater pressure on Japanese banks to write off their non-performing loans, and their improved capital position allowed them to do so with surprising rapidity. Hoshi and Kashyap (2011) judge that only Koizumi’s financial sector reforms were notably successful.

Growth accounting

A useful step for analyzing the factors for economic slowdown is to decompose GDP growth into the major contributing factors. Using the standard growth accounting framework, GDP growth is a function of the weighted shares of the growth of capital and labor inputs, plus TFP—the “residual” that cannot be explained by capital and labor inputs. Labor inputs in turn can be decomposed into the number of workers employed, labor quality, and changes in working hours per employee. Here we follow the notation of Hayashi and Prescott (2001) with slight modification for the specification of the aggregate production function:

$$Y = AK^\theta (hqE)^{1-\theta}$$

where Y is aggregate output, A is TFP, K is aggregate capital, E is aggregate employment, h is working hours per employee, and q is an index of labor quality. The parameter θ is the share of capital in national income, and the production function is assumed to have constant returns to scale, so the share of labor income is $1 - \theta$.

Following their notation further, let P be the total population and N be the working-age population (15–64) and define:

$$y = Y/P, n = N/P, e = E/N, x = K/Y,$$

where n is the working age population share and e is the employment ratio—the ratio of employed labor force to total working-age population—which comprises the labor-force participation rate and the employment rate in the total workforce. Using these definitions and by simple algebra, we obtain:

$$y = A^{1/1-\theta} h q n e x^{\theta/1-\theta}$$

Table 2 shows the contributions to Japanese real per capita GDP growth. The data through 1991 in the table are from Hayashi and Prescott (2001). The table shows a sharp slowdown in productivity growth since 1992, which was the time of the onset of the Japanese banking crisis according to Reinhart and Rogoff (2009). In the period 1992–2001, productivity rose at an average rate of only 0.3%. By far the biggest factor behind this slowdown was the actual drop of TFP during the period, with smaller contributions from a larger decline in the work week compared with previously, a decline in the employment rate, and a decline in the share of the working-age population. Somewhat surprisingly, the contribution from capital deepening rose sharply from the previous decade. However, this mainly seems to reflect the relatively slow response of capital spending during the early stages of the crisis, which led the capital stock to grow faster than output.

Per capita real GDP growth slowed significantly in the 1992–2011 period, mainly reflecting a large decline in the working-age population share, a decline in working hours, and a TFP growth slowdown relative to the previous periods. The contribution from capital intensity was large during the 1992–2001 period but came down sharply during 2002–2011, reflecting the sharp drop in net investment discussed above. This growth was well below the OECD average, and this, together with the very low contribution from capital accumulation, points to a longer lasting impact on growth from the crisis.

Table 2: Accounting for Japan’s Per Capita Real GDP Growth (%), 1962– 2011

Period	Per capita growth rate	Contributing factors (average % contribution)					Working age pop’n share
		TFP	Capital intensity	Workweek length	Employment ratio	Labor quality	
1962–1971	8.1	5.5	2.3	-0.2	-0.5	0.4	0.6
1972–1981	3.2	1.3	2.1	-0.3	0.0	0.4	-0.2
1982–1991	3.5	2.9	0.2	-0.5	0.2	0.4	0.4
1992–2001	0.3	-0.7	1.6	-0.9	-0.1	0.7	-0.3
2002–2011	0.0	0.6	0.1	-0.6	0.2	0.4	-0.6

GDP = gross domestic product; TFP = total factor productivity.

Note: The growth rate is that of per capita real GDP. Working age population is population aged 15 to 64.

Source: Based on Hayashi and Prescott (2001) for the first three periods; Cabinet Office, Government of Japan; Conference Board, *Total Economy Database*, for TFP and labor quality; Japan Statistics Bureau; and authors’ estimates for the last two periods.

3. INTERNATIONAL COMPARATIVE PERSPECTIVES OF BANKING CRISIS EXPERIENCES

3.1 Literature Survey

Banking crisis databases

Financial crises are typically divided into systemic banking crises, sovereign debt crises, and currency crises, and two or more of these may occur in combination. In the 1990s (or in any postwar period), Japan did not suffer sovereign debt crises or currency crises, so we focus our attention in this paper on banking crises. Two of the most recent large international databases on systemic banking crises are provided in Laeven and Valencia (2008) and Reinhart and Rogoff (2009).

Banking crises tend not to be as clear-cut as currency or sovereign debt crises. Laeven and Valencia (2008: 5) define a systemic banking crisis in the following way:

“...a country’s corporate and financial sectors experience a large number of defaults and financial institutions and corporations face great difficulties repaying contracts on time. As a result, non-performing loans increase sharply and all or most of the aggregate banking system capital is exhausted.”

Reinhart and Rogoff (2009, 10) define a banking crisis as:

“...two types of events: (1) bank runs that lead to the closure, merging, or takeover by the public sector of one or more financial institutions (as in Venezuela in 1993 or Argentina in 2001); and (2) if there are no runs, the closure, merging, takeover, or large-scale government assistance of an important financial institution (or group of institutions) that marks the start of a string of similar outcomes for other financial institutions (as in Thailand 1996–97).”

Laeven and Valencia (2008) only identify the year associated with the onset of a banking crisis, while Reinhart and Rogoff (2009) identify the entire period of a crisis. Laeven and Valencia’s database identifies 124 systemic banking crises over the period from 1970 to 2007. They also provide detailed information on crisis management strategies for 42 systemic banking crises from 37 countries, e.g., whether or not there was forbearance. The Reinhart and Rogoff (2009, 2010) database goes all the way back to 1800. For the most part, the beginnings of crisis periods in the two databases correspond, but there are exceptions, some quite notable. For example, Laeven and Valencia date Japan’s crisis as starting in 1997, when major bankruptcies and bailouts took place, while Reinhart and Rogoff (2009) date it from 1992, when the bubble began to burst. This suggests caution in putting too much emphasis on the exact date of a crisis.

Banking crisis and growth

Many studies have analyzed the effect of banking crises on economic growth, but most of these have focused on measuring cumulative output losses or the pace of the subsequent economic recovery. Relatively few have analyzed the impact of banking crises on long-term economic growth. Cecchetti, Kohler, and Upper (2009) examined if the timing of financial crises coincided with downward breaks in trend growth rates. This comes close to

the objective of our study. Their regression equation attempts to find out whether the growth rate of real GDP shows a break in the level and/or the long-term trend at the time of the crisis by including dummies for the timing of the crisis and the interaction between time and the dummy variable. They identify crisis periods based on Laeven and Valencia (2008).

Using a sample of 40 crises, for both developed and emerging/developing economies from all regions, they found a drop in the level of GDP after the crisis in over half of the cases, although only significant for one-fifth of the sample. Post-crisis trend growth rates actually rose in most cases, but this did not necessarily compensate for the initial loss of output. In eight cases they found lower trend growth rates, including in Indonesia, Japan, Malaysia, and Thailand, and most of these were associated with downward level breaks as well. It is interesting to note the concentration of Asian countries in this group.

Furceri and Mourougane (2009) analyzed financial crises in 30 OECD economies from 1960 to 2007, estimating a univariate autoregressive growth equation and deriving the relative impulse response functions where the left-hand side variable was potential growth and explanatory variables were crisis period dummy variables. They found that financial crises lowered trend growth rates on average by two percentage points. As potential growth rates are hard to estimate, they used two approaches as a cross-check—the OECD estimates based on a production function approach, and simpler smoothing techniques using a Hodrick-Prescott (HP) filter—and found relatively similar results.

However, these studies only attempted to measure the effects of banking crises on growth, with no attempt to analyze what other variables may have contributed to the deterioration of growth performance after crises. Also, they used the overall growth rate of GDP as the dependent variable, rather than the growth rate of per capita or per worker GDP, so did not fully take account of changes in demographic patterns.

Barro (2001) analyzed the impact of various factors on longer-term growth rates of per capita real GDP and the ratio of investment to GDP for a panel of 67 countries. He regressed five-year average growth rates against a number of explanatory variables—such as the initial level of per capita GDP, quality of human capital, measures of government policy and institutions, trade openness, inflation, the fixed-investment-to-GDP ratio, and crisis period dummies. He found that the five Asian crisis-affected countries (Indonesia, the Republic of Korea, Malaysia, the Philippines, and Thailand) grew during 1995–2000 at about 4% per year below the rate that would otherwise have been predicted by the set of explanatory variables—a highly significant shortfall. For the overall sample of countries, he found that crises did not affect output growth five years later, but his result excluded the effects of the output losses during the crisis period.

Barro's approach is very useful, as it develops predicted values for growth rates based on various factors, and identifies cases when countries' growth rates were higher than predicted before a crisis as well as when they were lower than predicted after a crisis. This provides much more information than when just comparing pre-crisis and post-crisis growth rates.

3.2 International Experiences of Banking Crises

This section compares Japan's banking crisis experience with those of other countries. Specifically, we compare Japan with three groups of countries that also experienced banking crises in the 1990s—OECD, Asian, and Latin American countries. Annex Figures 1–3 provide information about the performance of per capita real GDP in these countries. Japan did not experience a sharp decline in per capita real GDP—unlike the case of Finland (1991–93), Sweden (1991–93), Indonesia (1998–99), or Thailand (1996–97)—but saw a significant slowdown in the growth of per capita real GDP during the 1990s and 2000s. Japan's per capita real GDP reached a peak in 1997 and then contracted for two years, taking six years to recover the previous peak in 2003. Six years are much longer than the recovery period among the developed economies that contracted due to banking crises in the 1990s, except for Finland which took seven years to recover from the previous peak. (Australia took three years; France, two years; Italy, two years; Sweden, five years; UK, three years; and US, two years.) Interestingly, most emerging Asian countries that were affected by banking crises had to spend as many years as Japan before recovering their previous peaks except for the Republic of Korea which recovered in only two years. (Indonesia took eight years; Malaysia, six years; Philippines, five years; and Thailand, six years). Per capita real GDP in Latin America was much more volatile than in Japan.

OECD countries

Table 3 compares Japan's experience with those of seven other OECD countries that also had banking crises during the 1990s, based on the Reinhart-Rogoff data. Choosing countries on this basis allows us to analyze the growth experience in the decade before the crisis, the decade during the crisis, and the decade after the crisis. However, the comparison is not perfect, as some countries experienced crises in either the 1980s or the 2000s as well as in the 1990s. For example, Australia and the US had banking crises in the 1980s that continued until the 1990s. The UK had banking crises in the 1980s and the 2000s in addition to the 1990s. France and the US also had banking crises in the 2000s. The table shows averages for each decade for the level of per capital real GDP, the growth rate of per capita real GDP, the contribution to GDP growth from the capital stock, the ratio of domestic credit to GDP, and the change in housing prices. Barro (2001) examined the ratio of investment to GDP, but we believe that the contribution to growth from the capital stock is a better measure, as it likely captures net investment rather than gross investment, as described earlier in the paper.

The table shows that all of these countries had relatively similar levels of per capita GDP, and Japan's level was quite close to the average, so this can be considered a peer group. However, Japan's experience stands out in several ways. First, it had by far the highest growth rate of per capita real GDP during the 1980s, nearly twice the average rate, while it had the lowest growth rate in the 1990s. By the 2000s, its growth rate was only slightly below the average for these countries, perhaps because of the severe negative impact of the global and euro area financial crises on the US, Italy, and France. Second, its capital stock contribution was the highest in the 1990s, but at the low end in the 2000s.¹² Third, all

¹² Data are not available in all countries for capital stock contribution to GDP growth in the 1980s.

Table 3: OECD Countries' Experience with Banking Crises in the 1990s

Variable and period	Australia	Finland	France	Italy	Japan	Sweden	UK	US	Average
Crisis years	1989–92	1991–94	1994–95, 2008–10	1990–95	1992–2001	1991–94	1984, 1991, 1995, 2007–09	1984–91, 2007–10	---
Per capita real GDP (2005 international dollars)									
1980–1990	21,172	19,922	21,500	20,470	20,946	22,083	20,137	28,059	21,786
1990–2000	25,409	22,675	25,303	25,061	27,885	24,927	24,929	34,115	26,288
2000–2010	32,055	30,237	29,240	28,164	30,017	31,913	32,090	41,493	31,901
Growth rate of per capita real GDP (annual average %)									
1980–1990	1.9	2.6	1.8	2.3	4.0	1.9	2.5	2.3	2.4
1990–2000	2.1	1.7	1.5	1.6	0.9	1.7	2.2	2.2	1.7
2000–2010	1.6	1.4	0.4	-0.2	0.7	1.6	1.2	0.6	0.9
Capital stock contribution to GDP growth (average % points)									
1990–2000	0.8	0.6	1.1	0.7	1.6	0.6	1.2	0.9	0.9
2000–2010	1.7	0.6	1.2	0.8	0.6	1.0	1.0	0.9	1.0
CPI inflation rate (annual average %)									
1980–1990	8.4	7.3	7.4	11.2	2.5	7.9	7.0	5.6	7.2
1990–2000	2.5	2.1	1.9	4.1	1.2	3.3	3.3	3.0	2.7
2000–2010	3.2	1.8	1.7	2.3	-0.3	1.5	1.8	2.6	1.8
Domestic credit/GDP (%)									
1980–1990	36.8	61.2	91.9	51.1	152.7	85.9	60.4	106.3	80.8
1990–2000	69.2	69.7	88.3	58.3	205.3	107.1	113.0	139.0	106.2
2000–2010	107.2	71.4	95.5	90.0	186.6	104.6	163.7	190.3	126.2
Rate of change in housing price (period average %)									
1980–1990	10.3	12.2	6.9	13.0	---	7.4	4.6	---	9.1
1990–2000	4.1	0.8	1.9	2.4	---	2.9	3.8	---	2.7
2000–2010	9.2	6.1	7.5	5.0	---	7.2	3.0	---	6.3

OECD = Organisation for Economic Cooperation and Development; UK = United Kingdom; US = United States; GDP = gross domestic product; CPI = consumer price index.

Note: The crisis years cover all the periods and are based on Reinhart and Rogoff (2009). Dashes indicate data are not available.

Source: World Bank, World Development Indicators database, for per capita real GDP (in constant 2005 international dollars) and domestic credit/GDP; IMF, International Financial Statistics, for CPI inflation rates; Conference Board, Total Economy Database, for capital stock contribution to GDP growth; and Bank for International Settlements for housing prices.

countries saw substantial declines in CPI inflation rates over the last three decades, but only Japan experienced outright deflation in the 2000s. Fourth, Japan's ratio of domestic credit to GDP was by far the highest, almost twice the group average in the 1980s and 1990s. Moreover, it saw the largest decline in the credit-to-GDP ratio in the 2000s, while Sweden was the only other country in the group to experience a decline. However, in the 2000s, the domestic credit ratio of the US exceeded that of Japan, and the UK was not far behind. Finally, Japan was the only country to experience housing price declines throughout the 1990s and 2000s, which presumably was closely related to the substantial deleveraging observed during that period.

Thus, in comparison with its OECD peers, Japan's growth experience was relatively extreme in terms of the initial growth rate of per capita real GDP, growth of the capital-output ratio, and degree of leverage. It seems reasonable to conclude that these extreme levels—together with inadequate monetary policy—contributed to the severity of the subsequent slowdown of trend growth, the degree of deleveraging, and the extent of deflation. This seems to be a byproduct of rapid investment-driven growth financed by banking sector loans with real estate as collateral in the pre-crisis period. Among other OECD peers, the high government debt levels seen in the US and the UK make them the most likely candidates for Japanization. However, the more stable performance of per

capita real GDP growth and the capital stock growth contribution in those countries suggests that their reactions are likely to be less severe than was the case for Japan.

Asian financial crisis countries

Table 4 shows similar data for seven emerging Asian countries plus Japan (as a reference). The data are the same as in Table 3, except that housing price data are not available for most countries, so they are replaced with the ratio of external debt to national income. Most emerging Asian countries were affected by the Asian financial crisis of 1997–98, but the People’s Republic of China (PRC) and India also experienced banking crises that started in the early 1990s. It is interesting to see that the Republic of Korea, Malaysia, the Philippines, and Thailand experienced banking crises in the 1980s in addition to the 1990s and that no country had a banking crisis in the 2000s, except that the crises in the 1990s did not end until the early 2000s for most countries.

Table 4: Emerging Asia’s Experience with Banking Crises in 1990s

Variable and period	PRC	India	Indonesia	Republic of Korea	Malaysia	Philippines	Thailand	Average	Japan
Crisis years	1992–99	1993–98	1992, 1994, 1997–2002	1983, 1985–88, 1997–2002	1985–88, 1997–2001	1981–87, 1997–98	1980–87, 1996–2001	---	1992–2001
Per capita real GDP (2005 international dollars)									
1980–1990	779	1,005	1,559	7,673	5,702	2,592	2,704	3,145	20,946
1990–2000	1,766	1,391	2,500	14,813	8,917	2,543	5,073	5,286	27,885
2000–2010	4,164	2,191	3,092	22,391	11,843	3,023	6,481	7,598	30,017
Growth rate of per capita real GDP (annual average %)									
1980–1990	7.7	3.2	4.3	7.5	3.1	-1.0	5.9	4.4	4.0
1990–2000	9.3	3.6	2.7	5.1	4.4	0.6	3.4	4.2	0.9
2000–2010	9.8	6.0	4.0	3.6	2.6	2.8	3.4	4.6	0.7
Capital stock contribution to GDP growth (average % points)									
1990–2000	4.0	2.4	3.6	3.2	3.8	1.8	4.4	3.3	1.6
2000–2010	5.0	3.1	2.4	1.7	1.3	1.6	1.5	2.4	0.6
CPI inflation rate (annual average %)									
1980–1990	14.8	8.8	9.6	8.4	3.7	14.9	5.8	8.5	2.5
1990–2000	7.8	9.5	14.5	5.7	3.7	9.0	5.0	7.6	1.2
2000–2010	1.8	5.6	8.4	3.1	2.2	4.6	2.4	4.2	-0.3
Domestic credit/GDP (%)									
1980–1990	66.1	23.5	19.7	46.2	76.8	24.4	54.8	44.5	152.7
1990–2000	93.9	23.5	48.5	58.4	119.9	33.8	125.1	71.9	205.3
2000–2010	115.2	37.8	24.2	92.0	113.7	31.9	104.9	74.2	186.6
External debt/GNI (%)									
1980–1990	7.7	16.9	45.6	---	56.3	76.9	36.2	39.9	---
1990–2000	16.2	27.1	80.1	---	44.3	63.1	57.6	48.1	---
2000–2010	11.7	18.5	57.1	---	42.2	59.6	35.7	37.5	---

PRC = People’s Republic of China; GNI = gross national income; GDP = gross domestic product; CPI = consumer price index.

Note: The crisis years cover all the periods and are based on Reinhart and Rogoff (2009). Dashes indicate data are not available.

Source: World Bank, *World Development Indicators* database, for per capita real GDP (in constant 2005 international dollars) and domestic credit/GDP; IMF, *International Financial Statistics*, for CPI inflation rates and external debt/GNI; and Conference Board, *Total Economy Database*, for capital stock contribution to GDP growth.

In the emerging Asian economies, the average level of per capita real GDP in the 1980s was only about 15% of that of Japan, and rose to about 25% by the 2000s. Nonetheless, Japan’s growth rate in the 1980s was only slightly below the average for the emerging Asian economies during that period, which suggests that it was overachieving. Interestingly, the countries hit hardest by the Asian financial crisis—Indonesia, the Republic of Korea, Malaysia, and Thailand—saw sharp declines in the contribution to

growth from capital stock in the 2000s, and Malaysia's drop was bigger than that of Japan. In contrast, both the PRC and India showed greater contributions from the capital stock in the 2000s than in the 1990s, reflecting their higher investment ratios. CPI inflation rates generally fell over the period in emerging Asian economies, particularly in the 2000s, but only Japan experienced outright deflation. The ratio of domestic credit to GDP in Japan was much higher than those of emerging Asian economies throughout the period, even though those of the PRC, Malaysia, and Thailand had become relatively high by the 2000s. Domestic credit fell significantly in some Asian-crisis-affected countries (Indonesia, Malaysia, and Thailand) during the 2000s, but they were still able to maintain much higher growth rates than Japan was.

Latin American countries

Table 5 summarizes comparable data for seven Latin American countries that experienced banking crises during the 1990s. Four of them (Bolivia, Costa Rica, Mexico, and Brazil) also experienced banking crises during the 1980s, and the other two (the Dominican Republic and Guatemala) had banking crises in the 2000s before the outbreak of the global financial crisis, which makes their situation less comparable with that of Japan. Although the earlier crises were much shorter than those in the 1990s according to the Reinhart-Rogoff data, all Latin American economies exhibited stagnant growth in the 1980s.¹³

Table 5: Latin America's Experience with Banking Crises in the 1990s

Variable and period	Argentina	Bolivia	Brazil	Costa Rica	Dominican Republic	Guatemala	Mexico	Average	Japan
Crisis years	1980–82, 1989–90, 1995–96, 2001–03	1986–87, 1994–97, 1999	1985, 1990, 1994–97	1987, 1994–96	1996, 2003	1990, 2001, 2006	1981–82, 1994–2000	----	1992–2001
Per capita real GDP (2005 International dollars)									
1980–1990	3,560	3,237	7,239	5,842	3,887	3,416	10,035	6,084	20,946
1990–2000	8,822	3,329	7,496	7,081	4,552	3,611	10,471	6,642	27,885
2000–2010	9,618	3,804	8,566	9,100	6,589	4,118	12,136	8,102	30,017
Growth rate of per capita real GDP (annual average %)									
1980–1990	-3.0	-2.0	-0.5	-0.2	0.2	-1.5	-0.2	-0.5	4.0
1990–2000	3.3	1.5	1.0	2.7	4.2	1.7	1.7	2.3	0.9
2000–2010	2.1	2.0	2.5	2.5	3.8	0.8	0.5	2.0	0.7
Capital stock contribution to GDP growth (average % points)									
1990–2000	1.0	1.0	1.0	2.5	3.3	1.6	2.0	2.1	1.6
2000–2010	1.1	0.9	1.1	1.8	3.5	1.3	2.4	2.0	0.6
CPI inflation rate (annual average %)									
1980–1990	565.7	1,383.2	354.2	27.1	20.9	12.1	69.0	96.7	2.5
1990–2000	252.9	10.4	843.5	16.9	15.3	14.8	20.4	182.2	1.2
2000–2010	8.9	5.1	6.9	10.9	13.1	7.0	5.2	8.6	-0.3
Domestic credit/GDP (%)									
1980–1990	26.2	17.7	61.3	17.3	31.5	17.2	14.7	28.4	152.7
1990–2000	19.3	47.2	56.2	14.1	21.2	16.8	25.5	26.8	205.3
2000–2010	14.8	44.5	37.6	36.3	25.7	24.8	18.5	28.6	186.6
External debt/GNI (%)									
1980–1990	55.9	94.6	40.2	102.3	52.4	28.1	56.1	55.8	---
1990–2000	39.7	78.3	29.2	39.1	35.0	25.3	40.0	33.7	---
2000–2010	76.8	59.3	30.0	32.1	26.0	31.2	22.7	28.4	---

GDP = gross domestic product; CPI = consumer price index; GNI = gross national income.

¹³ Colombia, Peru, and Uruguay also experienced major banking crises in the 1980s, but sufficient data are not available for that period.

Note: The crisis years cover all the periods and are based on Reinhart and Rogoff (2009). Dashes indicate data are not available.

Source: World Bank, *World Development Indicators* database, for per capita real GDP (in constant 2005 international dollars) and domestic credit/GDP; IMF, *International Financial Statistics*, for CPI inflation rates and external debt/GNI; and Conference Board, *Total Economy Database*, for capital stock contribution to GDP growth.

Again, average per capita real GDP was far below that of Japan, ranging from 24% to 29%, and highest in relative terms during the 1980s. Remarkably, almost all the Latin American countries in the table saw declines in per capita real GDP in the 1980s—often called the “lost decade”—but recovered to moderate but steady growth in the following two decades. The Latin American countries were able to maintain steady growth of their capital stocks in the 1990s and 2000s, unlike Japan, but again, the pace was fairly moderate. Argentina and Brazil experienced periods of hyperinflation in the 1980s and 1990s and Bolivia in the 1980s, but all countries, except Costa Rica and the Dominican Republic, achieved single-digit inflation in the 2000s. The ratios of domestic credit to GDP in Latin America were far lower than that of Japan, and fell in the 2000s in Bolivia, Brazil, and Mexico. External debt ratios also fell in Bolivia, Costa Rica, the Dominican Republic, and Mexico in the 2000s.

Summing up

Several findings emerge from these international comparisons. First, Japan’s growth rate of per capita real GDP in the 1980s was much higher than the rates of its peers in the OECD country group, as well as in Latin American countries, and was nearly on a par with those of emerging Asian economies that had far lower per capita GDP. But Japan’s growth rate together with the CPI inflation rate came down in the 1990s and 2000s. Second, Japan’s high growth rate in the 1980s was closely related to its high level of domestic credit at the time, far higher than any other country examined here. Third, the sharp decline in the contribution from the capital stock in Japan in the 2000s, which we identify with lower net investment, was found neither among the OECD peer group nor the Latin American countries, but was observed in the four Asian countries hit hardest by the Asian crisis. Thus, this phenomenon seems to be associated with the investment-led “Asian” growth model.

4. ECONOMETRIC ANALYSIS OF BANKING CRISES AND GROWTH

4.1 Regression Analysis of Growth and Banking Crises

In this section, we attempt to identify the determinants of long-term growth rates econometrically, using a variety of explanatory variables, including dummies related to banking crises. Our estimation model is similar to that of Barro (2001) except that we focus on a different set of variables that may explain a structural slowdown in growth. Also, we take advantage of the fact that another decade of data is available, which provides a sufficient time lag after banking crises in the 1990s to provide more evidence of their long-term effects.

We use an unbalanced panel of 64 countries, including both developed and emerging/developing economies, over the 1990–2009 period, which is split into four five-year subperiods. The left-hand side variables are the five-year average growth rate of per

capita or per worker real GDP in constant 1990 dollar PPP terms from the World Bank database. As explanatory variables, first we include standard determinants of per capita real GDP growth: the initial level of log per capita real GDP (expected to be a negative factor due to the convergence hypothesis), and two alternative measures of capital accumulation, i.e., the ratio of net investment to GDP and the contribution to growth from the capital stock (positive factor). Second, we include a financial factor—the change in the ratio of domestic credit to GDP from the previous period—which may affect growth positively. Third, we include the CPI inflation rate to see if low inflation (or deflation) can cause a decline in per capita or per worker real GDP growth. Fourth, we include the real effective exchange rate (REER), the appreciation of which may retard per capita or per worker real GDP growth. Two measures of the REER—the log difference from the average of the previous five-year period and the five-year average of the deviation from the 10-year moving average—are tried. Fifth, to capture the effect of banking crises, a crisis dummy variable is included with a value of unity if a crisis is identified in the Reinhart-Rogoff database and zero otherwise. A separate dummy is also included for the 2007–09 period to capture the effect of the global financial crisis (GFC).

Structural variables that may affect growth include the ratio of the stock of inward FDI to GDP (*Inward FDI stock/GDP*) as a measure of economic openness, the share of the population with a secondary education in the total population (*Education*), and demographic factors (*Aged/Pop*), i.e., the share of the population aged 65 or higher in the total population.¹⁴

The first equation to estimate per capita real GDP growth is:

$$\begin{aligned}
 (\text{Growth rate of GDP/Pop})_{jt} &= \alpha * \text{Constant} + \beta * \ln(\text{GDP/Pop})_{jt0} \\
 &+ \gamma * (\text{Net investment/GDP})_{jt} + \delta_1 * (\text{CPI inflation})_{jt} + \delta_2 * [(\text{CPI inflation})_{jt}]^2 + \\
 &\varepsilon_1 * (\text{REER deviation})_{jt} + \varepsilon_2 * \Delta(\text{Domestic credit/GDP})_{jt} + \\
 &\varepsilon_3 * (\text{Banking crisis dummy})_{jt} + \varepsilon_4 * (\text{GFC dummy})_{jt} + \\
 &\varepsilon_5 * (\text{Inward FDI stock/GDP})_{jt} + \varepsilon_6 * \text{Education}_{jt} + \zeta_1 * (\text{Aged/Pop})_{jt} + \\
 &\zeta_2 * [(\text{Aged/Pop})_{jt}]^2 + u_{jt}
 \end{aligned} \tag{1}$$

where j refers to country, t is the sample period, and t_0 is the initial year of period t . The next equation (2) is the same as equation (1), except that the net investment term (*Net investment/GDP*) is replaced by the contribution to GDP growth from the capital stock (*Capital contribution*). Equations (3) and (4) are the corresponding specifications to estimate the growth rate of per worker (employed) real GDP using the initial level of log per worker (employed) real GDP as an explanatory variable. Annex Table summarizes variable definitions and data sources.

The estimation procedure is three-stage least squares, which takes into account the possible endogeneity of the CPI inflation rate, the ratio of domestic credit to GDP, the REER deviation, and the alternative measures of capital accumulation. Table 6 shows the regression results for growth rates of per capita real GDP using the two alternative measures of capital accumulation—net investment ratio in equation (1) and capital stock

¹⁴ A number of steps were taken to reduce outliers in the data, including deleting observations with inward FDI stock/GDP over 100%, CPI inflation over 30%, and changes in the ratio of private domestic credit to GDP over 40% (in absolute terms). Also, observations with per capita GDP levels less than \$1,000 were dropped.

contribution in equation (2)—and for the same alternatives for per worker real GDP in equations (3) and (4). Constant terms are not reported.

Table 6: Regression Results for Growth Rates of Per Capita/Worker Real GDP

Equation	(1) Growth rate of GDP/Pop	(2) Growth rate of GDP/Pop	(3) Growth rate of GDP/Worker	(4) Growth rate of GDP/Worker
Explanatory variables				
ln(GDP/Pop)₀ * 100	-0.593 (0.626)	-0.315 (0.314)	---	---
ln(GDP/Worker)₀ * 100	---	---	-1.257** (0.568)	-0.443 (0.397)
Net investment/GDP * 100	0.012 (0.026)	---	0.111*** (0.014)	---
Capital contribution * 100	---	1.340*** (0.094)	---	1.581*** (0.126)
CPI inflation * 100	-0.412 (0.287)	0.513*** (0.181)	0.869*** (0.180)	0.606*** (0.235)
[CPI inflation]² * 100	0.009 (0.010)	-0.021*** (0.007)	-0.036*** (0.006)	-0.024*** (0.009)
REER deviation * 100	-20.259*** (6.578)	9.277* (4.401)	16.033*** (5.846)	7.488 (5.883)
Δ(Domestic credit/GDP) * 100	-0.077*** (0.027)	-0.039* (0.024)	-0.007 (0.026)	-0.087*** (0.026)
Banking crisis dummy * 100	-1.827*** (0.704)	-0.392 (0.622)	-0.605 (0.631)	0.151 (0.750)
GFC dummy * 100	-0.777 (0.515)	-0.541* (0.308)	0.241 (0.460)	-0.580 (0.390)
Inward FDI stock/GDP * 100	-0.003 (0.011)	0.019*** (0.007)	0.022** (0.009)	0.021** (0.010)
Education * 100	0.003 (0.014)	-0.008 (0.012)	0.002 (0.012)	-0.006 (0.014)
Aged/Pop * 100	0.002 (0.432)	0.982*** (0.232)	0.734** (0.342)	0.923*** (0.307)
[Aged/Pop]² * 100	-0.009 (0.016)	-0.037*** (0.009)	-0.022* (0.013)	-0.030*** (0.012)
Number of observations	104	140	98	139
R-sq / Chi-sq	-0.24 / 39.05	0.26 / 299.83	-0.34 / 91.40	-0.17 / 224.64

Note: The results are for three-stage least squares where the consumer price index (CPI) inflation rate, the change in the domestic credit ratio, the real effective exchange rate (REER) deviation, and net investment (or capital contribution) measures are treated as endogenous variables. The equations for these four endogenous variables are not shown here. Numbers in parentheses are standard deviations, and statistical significance is measured by asterisks: * at the 10% level; ** at the 5% level, and *** at the 1% level.

Source: Authors' calculations.

The estimation results are broadly similar for the per capita and the per worker real GDP growth rate.

In equations (1) and (2), the initial year's per capita real GDP level coefficients have the expected positive signs, implying income convergence, but are not significant. The corresponding coefficients for per worker real GDP growth in equations (3) and (4) have the expected signs, but only that in equation (3) is statistically significant.

The coefficients on the ratio of net investment to GDP in equations (1) and (3) are positive, but only the latter is statistically significant. The coefficient in equation (3) implies that a one percentage point rise in the net investment ratio raises per capita real GDP growth by 0.1 percentage point. In equations (2) and (4), where the alternative measure of the contribution from the capital stock is used, the coefficients are also positive and statistically highly significant. The coefficients imply that a one percentage point contribution from capital stock growth raises the per capita and per worker GDP growth rate by 1.3 and 1.6 percentage points, respectively.

The coefficients on CPI inflation rates—the average of each five-year period—in equations (2), (3), and (4) reveal the expected signs, with the linear term positive and the quadratic term negative, and are statistically significant in these equations. The coefficients imply that the growth rate of per capita real GDP is low in countries with low inflation, increases with the rise of inflation up to 24%–26%, and then declines with the rise of inflation thereafter. The coefficients for equation (1) have the wrong signs and are not statistically significant. The results for equations (2) to (4) support the view that Japan's growth was negatively affected by its persistent price deflation.

The coefficients for a banking crisis are negative as expected in equations (1)–(3) but statistically significant only in equation (1). The coefficient in equation (1) implies that a banking crisis lowers the five-year average growth rate of per capita GDP by 1.8 percentage points. We tried to identify longer-term effects using the lagged value of the banking crisis dummy, but this did not work well, probably because of multicollinearity. The global financial crisis (GFC) dummy had the expected negative sign in equations (1), (2), and (4), but was only significant in equation (2). The coefficient in equation (2) implies that the global financial crisis likely reduced per capita GDP growth by 0.5 percentage point.

The coefficients for the ratio of the inward FDI stock to GDP are positive as expected, and statistically significant in equations (2)–(4). The coefficient estimates imply that a one percentage increase in the inward FDI stock ratio raises per capita and per worker growth by 0.2 percentage point. This suggests a positive structural effect from economic openness.

The coefficients on the ratio of the aged population to the total population have the expected signs of a positive coefficient for the linear term and a negative coefficient for the quadratic term and were significant in equations (2), (3), and (4). The positive sign of the linear term probably reflects the positive growth experience of many developing and emerging economies, while the negative sign for the quadratic term reflects the expected negative impact of highly aged societies, which tend to be developed countries. The coefficient estimates in equations (2), (3), and (4) imply that the per capita and per worker real GDP growth rate rises until the aged population ratio reaches 27% to 33%, begins to decline after such a threshold ratio, and actually turns negative once the ratio reaches 56% to 66%, a relatively high level.¹⁵ The results in equation (3) and (4) are powerful, as they correct for changes in the share of the labor force in the total population due to aging and thus imply that there is a direct effect of aging on labor productivity.

¹⁵ Japan's aged population share averaged 21% in the period 2005–2009, so this factor may have contributed to the country's low growth.

The coefficient on the REER deviation—the log difference from the previous five-year period average which turns out to yield better results than the alternative measure—is negative as expected and significant in equation (1), but positive in the other equations and significant in equations (2) and (3). The results do not provide strong support for the view that growth rates were negatively affected by currency appreciation. The coefficients on the change in the ratio of domestic credit to GDP are negative and statistically significant in all equations except (3), a surprising result contrary to our prior expectations. The coefficients for the education variable are not consistent in terms of signs and are not significant, a surprising result as other estimates indicated that it was positive and significant. These results suggest that further investigation may be needed.

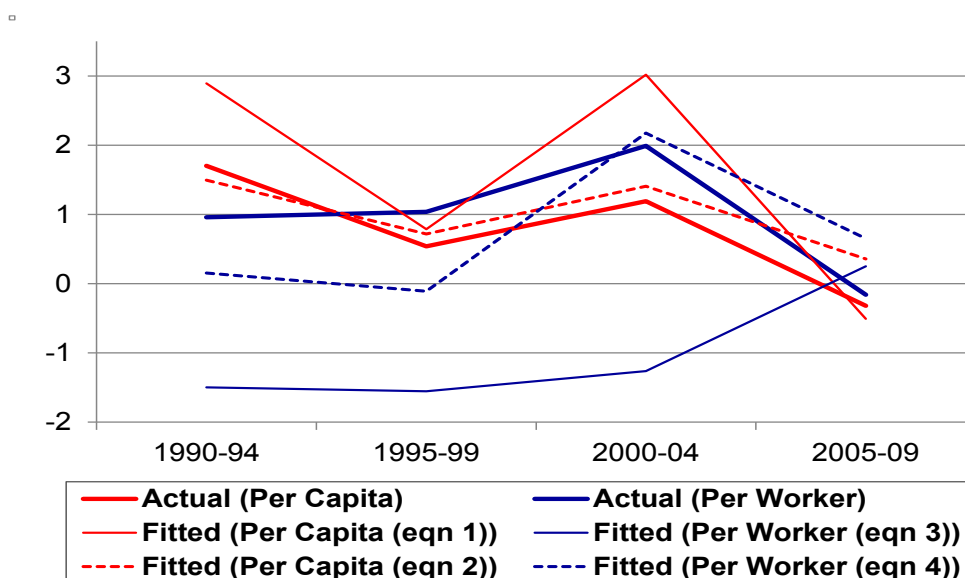
4.2 Interpretations of Results

Figure 9 shows the actual and predicted values for Japanese per capita and per worker real GDP growth rates based on the estimation results reported in Table 6. The fitted values for per capita real GDP growth, particularly based on equation (2), capture the trend well, while equation (1) shows somewhat higher growth than actual growth in 2000–04. The fitted values for per worker real GDP growth do not have as good a fit as those for per capita real GDP growth, though equation (4) performs better than equation (3). Overall, use of the capital stock contribution, rather than the net investment ratio, provides a better fit. In general, the biggest negative contributions to growth come from the slowdown in the pace of capital accumulation, the decline in the CPI inflation rate, the lack of openness of the economy, and the rise in the aged population share, though the contributions vary by equation. The contributions from the domestic credit ratio and the REER deviation are significant in some cases, but usually with the wrong sign. Other potentially important variables—such as the banking crisis dummy—make only modest contributions to growth.

The model predicts a slowdown in growth of other advanced economies as well, including the US, Germany, Italy, and the UK, which were hit by the global financial crisis. Aside from the crisis dummy, this mainly reflects declines in the net investment ratio or the capital stock contribution. In the case of the US, this effect is moderate during the estimation period, but recent slowdowns in the pace of capital accumulation suggest this will likely be more important in future. The aging effects are generally much smaller in these economies—such as the UK and US—compared with Japan, although Germany and Italy both show significant effects of aging.

Aside from banking crises and aging, the main factor behind lower growth is lower inflation (or deflation) and lower capital accumulation. This is particularly a problem in the near term for developed economies, since the rate of inflation is expected to remain low and the depreciation of the capital stock is high. The latter suggests that until a new equilibrium between new gross investment and depreciation of the capital stock is reached, net investment levels in developed economies are likely to remain depressed. These observations point to a need for continued monetary policy easing to avoid deflation and for structural measures to increase the attractiveness of investment—including deregulation, improved investment climate, and open policies toward FDI—and measures to stimulate labor supply.

Figure 9: Model Estimates of Japanese Per Capita/Worker Real GDP Growth
(Annual average rate of growth, %)



Note: The data plotted are actual and fitted values of the annual average growth rates of per capita and per worker real GDP. The fitted values are based on the results reported in Table 6.

Source: Authors' estimates.

5. CONCLUSION AND POLICY IMPLICATIONS

In this paper we have attempted to identify the major factors associated with Japanization, a broad-based and long-lasting stagnation in economic performance following the collapse of asset-price bubbles that led to a large-scale banking crisis. This stagnation in performance includes a significant slowdown in trend growth of per capita real GDP, a substantial period of deleveraging, slow or no growth in the capital-stock-to-GDP ratio, a decline in short- and long-term interest rates, and a substantial increase in the ratio of government debt to GDP. Other phenomena that may be more unique to Japan include a prolonged, substantial decline in stock and real estate prices, moderate but persistent price deflation, and a lack of nominal GDP growth. Japanization may have been aggravated by the rapid aging of the population.

The first best solution to avoid long-term stagnation following a collapse of asset-price bubbles is to prevent the bubbles themselves by containing economic overheating, excessive credit growth, overinvestment in fixed assets, and asset market speculation. From this perspective a combination of macroeconomic and macroprudential policy measures is essential to prevent asset-price bubbles. However, once the bubbles build up and then collapse, the second best policy is to quickly minimize the negative impact of such a collapse on the banking sector and overall economic activity through accommodative monetary policy and rapid financial policy responses to encourage banks to clean up their balance sheets. One of the reasons for Japan's poor economic performance in the 1990s is an inadequate policy response on the part of the central bank

and financial authorities—the latter of which adopted forbearance toward the banking sector until 1997, when a systemic banking crisis erupted. Lack of policy urgency—facilitated by large domestic savings and foreign exchange reserves as well as by sustained fiscal stimuli—was a serious mistake.

We have compared Japan's experience with those of a number of other countries that also had banking crises in the 1990s. Against these comparators, Japan's performance stands out in several ways. First, the growth rate of per capita real GDP it achieved during the 1980s—4% per year—was quite high compared with its peer group of OECD countries, and more in line with the experience of Asia's emerging economies with much lower per capita income levels. Second, its pace of capital accumulation was high among the OECD countries (but low in comparison to emerging economies) in the 1990s, but declined to the low end even among the OECD countries in the 2000s. Third, its ratio of domestic credit to GDP was significantly higher than the ratios in other OECD countries, and much higher than the norm for emerging economies, but fell unusually sharply in the 2000s. Fourth, housing prices declined on average throughout the decades of the 1990s and 2000s. In some ways, Japan's experience most resembles those of the countries hit directly by the Asian financial crisis—Indonesia, the Republic of Korea, Malaysia, and Thailand. This suggests that the origin of Japanization may lie partly in the adoption of the investment-led growth model financed by the banking sector.

Our econometric analysis—which accounts for a possible simultaneity bias of the key endogenous variables—shows that capital accumulation, the CPI inflation rate, economic openness measured by the stock of inward FDI as a ratio of GDP, and the share of the aged population (age 65 and over) in the total population are mostly significant determinants of long-term growth of per capita (or per worker) real GDP. In particular, very low rates of CPI inflation (or deflation) and subdued capital accumulation, coupled with the closed nature of the economy and an aged population, explain much of Japan's slowdown. Although the very large yen appreciation in the mid-1990s may have had a negative impact on growth, the regression analysis has not found the overall negative impact of the real effective exchange rate.

A decomposition of growth of Japan's real GDP per working-age person shows that, during the 1990s—the period of Japan's banking crisis—TFP declined and the average work week also shortened significantly, although the contribution to growth from the capital stock remained relatively strong. During the 2000s, the contribution from the capital stock slowed considerably, while TFP growth recovered somewhat. The overall slowdown of TFP growth in the post-bubble period could be due to the lack of structural reform and the aging of society. Our analysis suggests that structural policies to restore growth—directed toward promoting capital accumulation and further opening of the economy—would be critical particularly in post-crisis periods. Measures to stimulate corporate investment should include deregulation, liberalization of trade and FDI, increased labor market flexibility, and lower taxation of investment. Although little can be done to affect the share of the aged population in the total population, policies can encourage greater labor force participation, higher fertility rates, and labor immigration.

The question is whether the US and a number of major euro area economies that experienced recent large-scale financial (particularly banking) crises would face a similar risk of long-term stagnation or Japanization. There are some positive and negative factors regarding this. On the positive side, the experience of the US, the UK, and Italy shows that

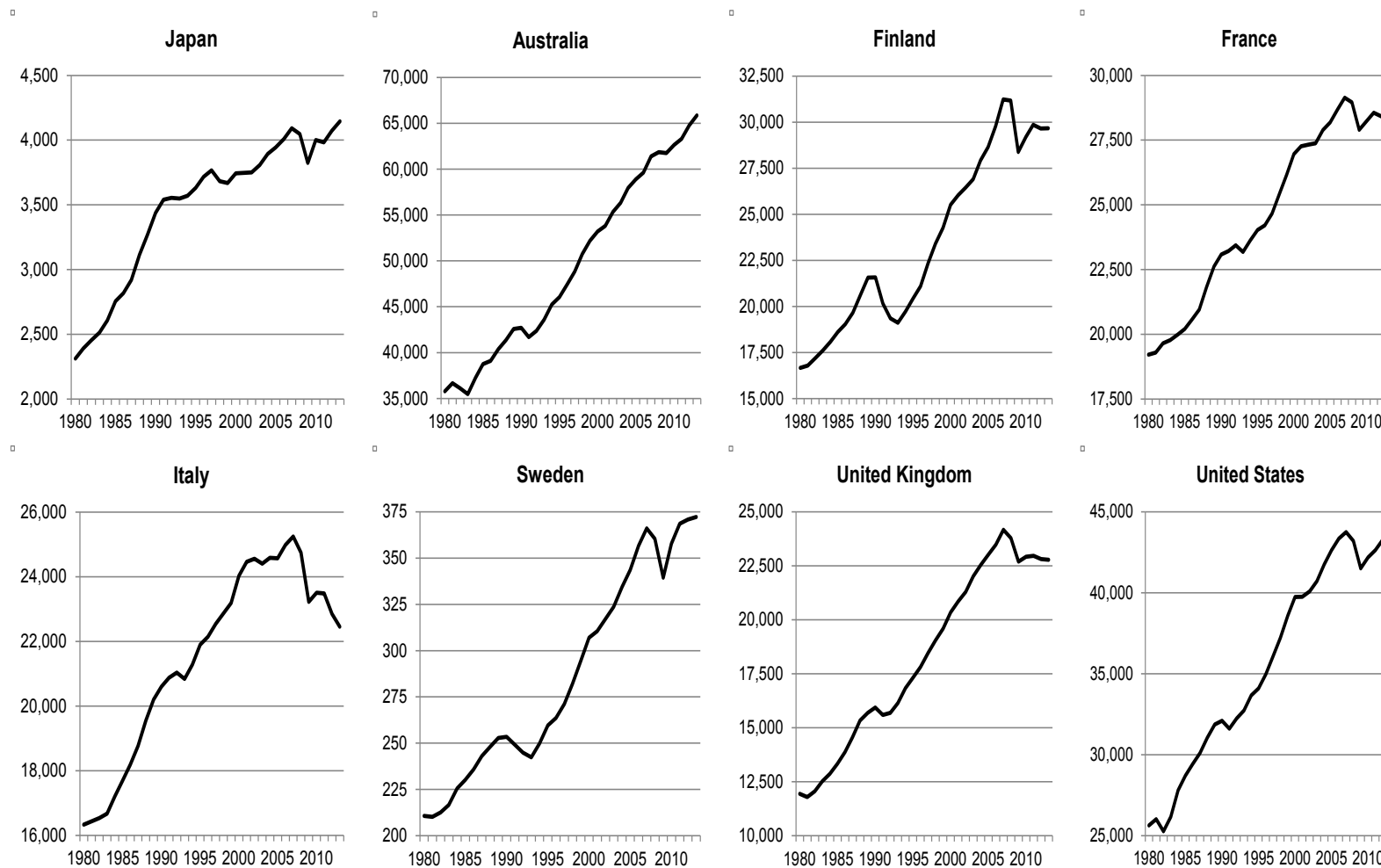
the average per capita GDP growth rates prior to the global financial crisis period were much lower than in Japan, ranging from 1.2% for Italy to 2.5% for the UK. Therefore, the initial extent of “excess” growth was much less. The contribution to growth from the capital stock was also lower in these countries than in Japan, again indicating less “excess” investment. On the negative side, low CPI inflation and a decline in net investment as a share of GDP after the global financial crisis—though not to the same extent as Japan—suggest some risk of Japanization. The very high levels of domestic credit relative to GDP in the pre-crisis period add to this risk. The slow response to banking sector problems in the euro area economies also points to a risk of long-term stagnation. Aging can be a significant negative factor for growth in major developed economies, such as Germany and Italy, but much less so in the UK and the US.

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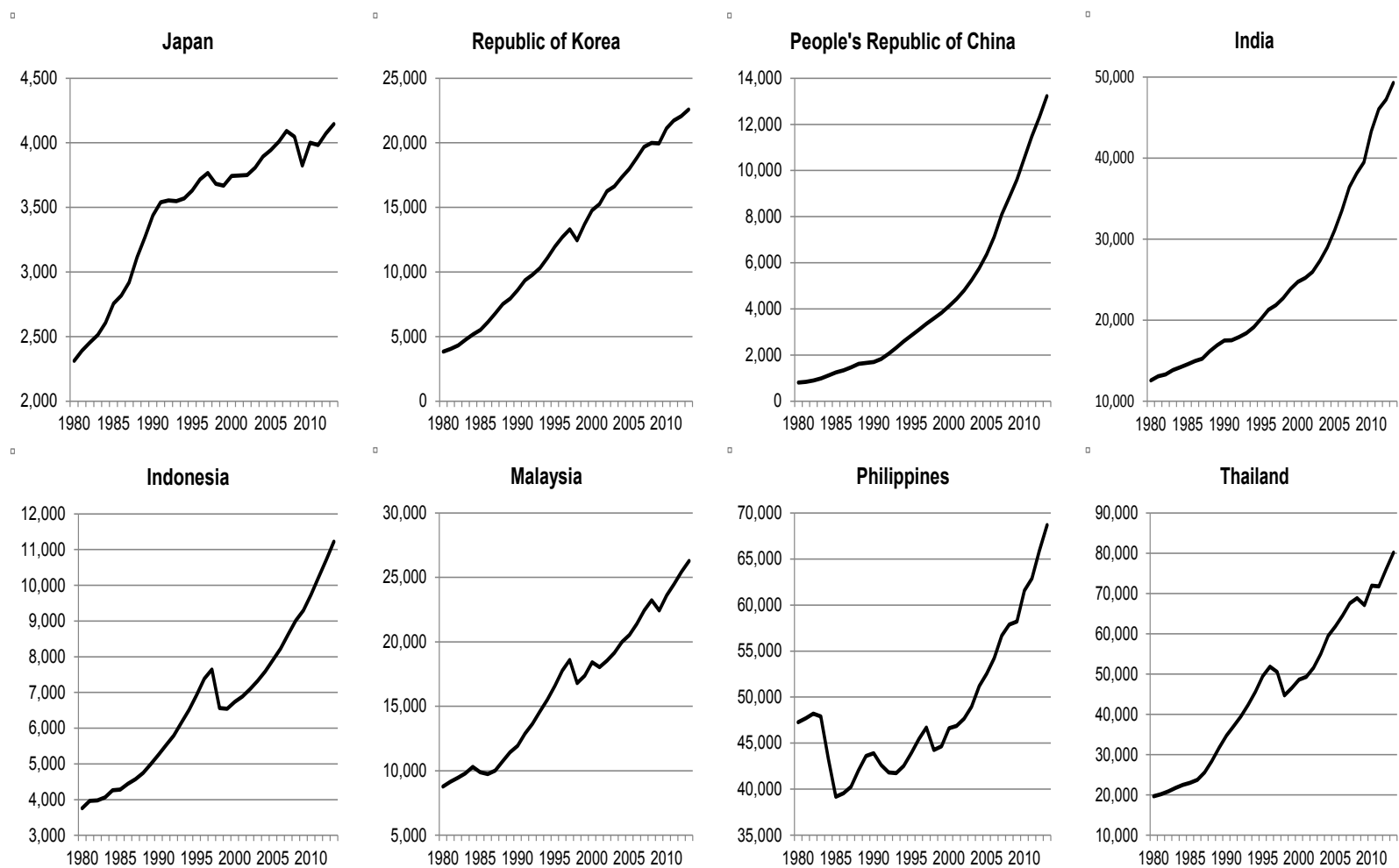
Annex Figure 1: Per Capita Real GDP of OECD Countries That Experienced Banking Crises in the 1990s



Note: Local currency in real terms with varying base years. Units are 1,000 yen for Japan and 1,000 kronor for Sweden.

Source: IMF, *World Economic Outlook* database (April 2013).

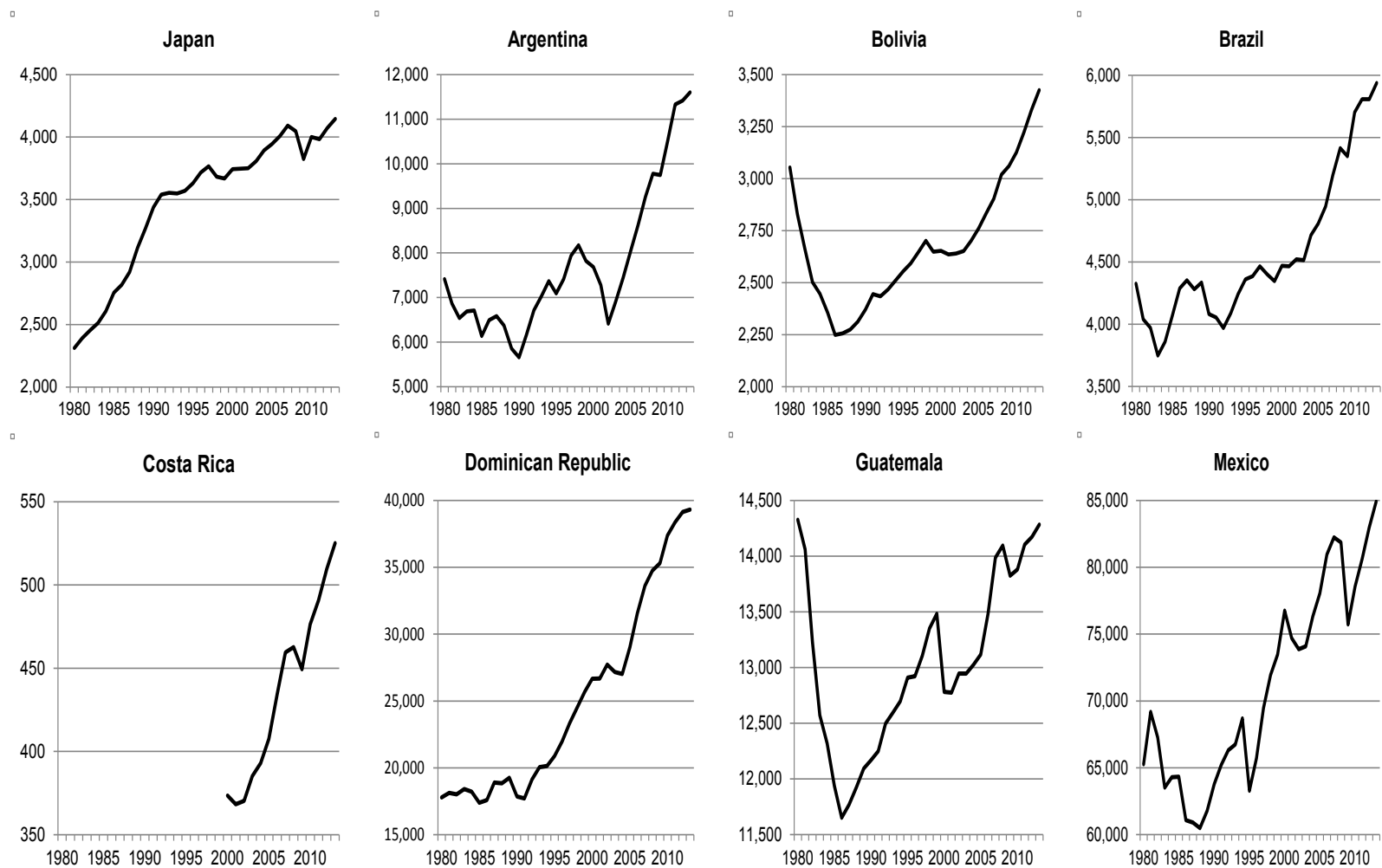
Annex Figure 2: Per Capita Real GDP of Asian Countries That Experienced Banking Crises in the 1990s



Note: Local currency in real terms with varying base years. Units are 1,000 yen for Japan, 1,000 won for the Republic of Korea, and 1,000 rupiah for Indonesia.

Source: IMF, *World Economic Outlook* database (April 2013).

Annex Figure 3: Per Capita Real GDP of Japan and Latin American Countries That Experienced Banking Crises in the 1990s



Note: Local currency in real terms with varying base years. Units are 1,000 yen for Japan.

Source: IMF, *World Economic Outlook* database (April 2013).

Annex Table: Definitions of Variables Used in Regression Analysis

Variable	Definition	Description and comments	Source
GDP/Pop	Per capita real GDP in constant 2005 international dollars; the grow rate is five-year average	GDP converted to constant 205 international dollars using purchasing power parity (PPP) rates, divided by the total population	World Bank, <i>World Development Indicators</i>
GDP/Worker	Per person employed real GDP in constant 1990 international dollars; the growth rate is five-year average	GDP converted to constant 1990 international dollars using PPP rates, divided by total employment in the economy	World Bank, <i>World Development Indicators</i>
Net investment/GDP	Ratio of net fixed capital formation to GDP, five-year average	The net value calculated as gross fixed capital formation minus consumption of fixed capital	CEIC; IMF, <i>International Financial Statistics</i>
Capital contribution	Contribution of capital services growth to GDP growth, five-year average	Sum of contribution of ICT and non-ICT capital services to GDP Growth	Conference Board, <i>Total Economy Database</i>
CPI inflation	Consumer price index (CPI) Inflation rate, five-year average	Consumer price indexes, nationally defined	World Bank, <i>World Development Indicators</i> ; and IMF, <i>World Economic Outlook</i>
REER deviation	Deviation of the real effective exchange rate (REER) index (2005 = 100) from the previous five-year period average	Real effective exchange rate is the geometric weighted average of bilateral exchange rates adjusted by relative consumer prices (2005)	World Bank, <i>World Development Indicators</i> ; BIS; and CEIC
Δ (Domestic credit/GDP)	Change in the ratio of domestic credit to private sector to GDP from the previous five-year period average	Domestic credit to private sector includes loans, purchases of nonequity securities, and trade credits and other accounts receivable that establish a claim for repayment. For some countries these claims include credit to public enterprises	World Bank, <i>World Development Indicators</i>
Banking crisis dummy	An event of a banking crisis, taking on value 1 if crisis occurs during five-year period and 0 otherwise	Two types of the banking crises are included: (1) systemic/severe and (2) financial distress/milder	Reinhart and Rogoff (2009)
GFC dummy	The global financial crisis (GFC) event, taking on value 1 during the 2005–09 period and 0 otherwise		
Inward FDI stock/GDP	Ratio of inward foreign direct investment (FDI) stock to GDP, five-year average	The stock of inward foreign direct investments as a ratio of GDP	UN Conference on Trade and Development (UNCTAD)
Education	Ratio of secondary school enrollment to the total secondary-school-age population, five-year average	The total gross enrollment in secondary education, regardless of age, as a ratio of the total population of official secondary education age. The ratio can exceed 100% because of the inclusion of over-aged and under-aged students due to early or late school entrance and grade repetition	World Bank, <i>World Development Indicators</i>
Aged/Pop	Ratio of the aged population to the total population, five-year average	The aged population (age 65 and above) as a ratio of the total population	World Bank, <i>World Development Indicators</i>

Source: Authors.