Japan's Stagnant Nineties:
A Vector Autoregression Retrospective

RAMANA RAMASWAMY and CHRISTEL RENDU*

This paper uses a vector autoregression (VAR) approach to identify the driving forces of the growth slowdown in Japan during the 1990s. Negative shocks to both residential and nonresidential investment are shown to have been important determinants of the slowdown. Despite the collapse in asset prices, negative shocks to private consumption were relatively small. A surprising conclusion is that trends in public consumption had a dampening impact on activity in the nineties. The VAR estimations do not support the counterfactual conjecture that activity in Japan would have been significantly weaker in the absence of the expansionary shift in fiscal policy. [JEL: C22, E10, E17, E32]

The Japanese economy experienced its worst postwar recession during 1997–98. The recent decline in activity followed on the heels of a seven-year period in which the Japanese economy grew at an average rate of just about $1^{1}/_{2}$ percent a year. The tepid economic performance of recent years contrasts starkly with the average growth rate of about 4 percent achieved during the 1980s. Moreover, the prolonged stagnation of activity in Japan in the 1990s has resulted in the most obvious desynchronization of the economic cycle among the major industrial countries in the postwar period.

A visible sign of the economic crisis in Japan could be seen in the banking sector. Moreover, the failure of both equity and land prices to recover from the collapse in the early 1990s and Moody's downgrading in November 1998 of Japan's sovereign debt in response to the rapidly rising fiscal deficits and public debt have further

heightened the unease about economic conditions in Japan. While Japan has so far avoided the high unemployment that would normally be associated with depressed activity levels of this magnitude, labor market conditions have deteriorated recently, with marked declines in both employment and job offers. A striking and somewhat novel aspect of the crisis in Japan can be seen in the limited options currently available for using traditional macroeconomic policy tools. With the Bank of Japan's overnight call rate currently close to zero, minimal further scope exists for providing support to the economy through a lowering of nominal short-term interest rates. Moreover, given the recent deterioration in public finances and the rise in long-term bond yields, the scope for further fiscal stimulus is also seriously limited.

How did Japan get saddled with problems of this magnitude? And what policy options are available for dealing with them? The focus of recent analyses, perhaps not surprisingly, has tended to be more on what should be done to get the Japanese economy back on track than on providing a systematic analysis of what went wrong. The policy literature falls into three broad groups. One view, associated prominently with the recent work of Posen (1998) and with some adherents in international policy circles, argues the case for a substantial fiscal stimulus to revive the Japanese economy. This viewpoint attributes the relative ineffectiveness of past fiscal stimulus packages both to the temporary nature of many of the measures undertaken and to the adoption of programs, such as land purchases, that have had little impact on activity, rather than to the inappropriateness of fiscal policy as an effective tool for reviving the economy.

Krugman (1998) makes the case for the continuing relevance of monetary policy in Japan, despite an apparent liquidity trap—i.e., the configuration of nominal interest rates close to zero, mild deflation, and a significant output gap. However, the liquidity trap implies that monetary policy has to be conducted primarily through injecting liquidity rather than by targeting an interest rate. Thus, the Bank of Japan ought to expand the monetary base in a sustained way in order to increase inflation expectations and lower real interest rates. Krugman downplays the importance of solving the banking crisis as a precondition for getting the Japanese economy moving. According to him, the interplay of adverse selection and moral hazard would have bad banks lending more, not less.

In contrast, the credit-crunch viewpoint argues that recent reforms in the banking sector in Japan, such as the implementation of "prompt corrective action" rules, discourage banks in difficulties from lending indiscriminately. There is some empirical evidence that lends credence to the hypothesis of activity being dampened recently by a credit crunch.[1]

The above discussion suggests no clear consensus has been formed on the policy measures needed for reviving the Japanese economy. The aim of this paper is not to make an explicit case for adopting one policy option over another. Instead, the focus is primarily on providing a systematic analysis of the factors leading up to the present conundrum in Japan. The reasons for the emphasis on what happened, rather than on what ought now to be done, are twofold. One follows

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[1]Bayoumi (1998a) uses VAR estimations to provide evidence for the hypothesis that disruptions to bank lending have played an important role in explaining the recent weaknesses in activity.

from the obvious perspective that a better understanding of the recent past should help in making more reasoned choices among the different policy options. The other, as observed earlier, is driven by the relative paucity of econometric work on what went wrong in Japan in the 1990s. While some of the popular writings on recent developments in Japan have been perceptive, they have had a tendency to be either discursive or sweeping in their generalizations. It is not easy, for instance, to test empirically the role played by such structural factors as life-time employment practices, the nature of financial intermediation, or the pursuit of implicit industrial policies in dampening growth in the 1990s. It is, however, more tractable to test econometrically the validity of generally held beliefs regarding the role of macroeconomic factors in inducing the stagnation of output in the 1990s.

This paper uses a vector autoregression (VAR) model, with structural identifying restrictions, to quantify the extent to which the growth slowdown in Japan during the 1990s was driven by shocks to the different expenditure components of real GDP. VAR estimations of this type can prove useful in providing techniques for quantifying existing intuitions about, for instance, whether negative shocks to private investment were more important than negative shocks to private consumption in dampening activity in the 1990s. Moreover, the results thrown up by such estimations may motivate the questioning of existing priors, such as whether developments in international trade did play an important role, and also uncover new stylized facts that explain the slowdown in activity. Further, as discussed below, the VAR approach can be useful in providing benchmarks for evaluating the effectiveness of macroeconomic policies—i.e., for providing a counterfactual scenario of whether the economy would have been better or worse off in the absence of the monetary and fiscal policies that were actually pursued.

The main conclusions of this paper are (i) negative shocks to both residential and nonresidential private investment contributed importantly to the marked deceleration of output in the nineties; (ii) despite the collapse of both equity and land prices in the 1990s, there has not been a large buildup of negative shocks to private consumption; (iii) significant negative shocks to public consumption, rather surprisingly, are also shown to have played a role in dampening activity in the 1990s—an explanation that figures prominently in the VAR estimations, but one that appears to have been neglected in most recent analyses of Japan; (iv) despite the strong appreciation of the yen during the first half of the nineties, the external sector does not appear to have been a major drag on growth; and (v) the VAR estimations do not provide supporting evidence for the counterfactual conjecture that activity would have been significantly weaker in the absence of the expansionary shift in the stance of fiscal policy in the 1990s. The paper suggests intuitive arguments backing each of these findings.

I. VAR Model and Data

A VAR is a multivariate simultaneous equation system, in which each variable under study is regressed on a finite number of lags of all variables jointly considered. The VAR approach is useful when the intention is to analyze a phenomenon without necessarily having any strong priors about competing explanations of it. The method allows the regularities found in the data to tell the story. However, given that such an

approach does not impose a prior theoretical structure on the data, it is important to combine the results coming out of the VAR estimations with explanations of why they should make intuitive sense. This paper attempts such a juxtaposition in discussing the types of shocks that the Japanese economy was subject to in the 1990s and draws conclusions about the effectiveness of the policies pursued during this period.

The VAR model adopted for analyzing economic developments in the 1990s in Japan focuses on the different components of the national accounts and is sequenced in two steps.[2] The baseline, eight-variable VAR is composed of private consumption, private nonresidential fixed investment, private residential fixed investment, public investment, public consumption, exports, imports, and inventories, all measured in constant 1990 prices. The data are obtained from NIKKEI Telecom and span the period 1973:Q1 to 1998:Q2.[3] Unit root tests (Table 1) indicate that the levels of these variables are nonstationary. Accordingly, all variables except inventories are introduced in first difference logs.[4] Inventories are entered into the model as a ratio of GDP (and this ratio is stationary). GDP is derived as an auxiliary equation given that it is the sum of the components in the VAR. The system is estimated with the smallest number of lags necessary to obtain white-noise residuals in all equations of the system, whereby the whiteness of the residuals is tested using the Ljung-Box Q statistic. We find that two lags are sufficient. Using this criterion as a basis for choosing the optimal lag length makes sense in large systems where parsimony becomes an issue; moreover, the results were stable when experimented with three and four lags.

The baseline VAR is estimated to obtain an indication of what the innovations of each of the expenditure equations look like. The estimated residuals U_{it} (see appendix for details) of each of the equations of the VAR provides us with a potential benchmark for judging whether the behavior of a variable in any given period deviates markedly from the previous history of the system. For instance, when a large residual is obtained for private consumption, it indicates a change in the pattern of private consumption expenditure that is explained neither by the past history of the pattern of private consumption expenditure nor by the history of changes in the other components of the VAR system.

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[2]The model is illustrated in the appendix at the end of this paper. The methodology adopted for the VAR estimations in this paper follows closely the approaches adopted for analyzing the 1990–91 recession in the United States, by Blanchard (1993), and the 1990–92 recession in the United Kingdom, by Catão and Ramaswamy (1996).

[3]Note that the data can also be obtained from the Nomura Research database.

[4]We further test if the variables are cointegrated. The Johansen rank test reveals the presence of three cointegrating relationships. Based on this finding the natural modeling strategy would appear to be to estimate a vector error correction mechanism (VECM) with three cointegrating vectors. However, the problem with this strategy lies in assigning economic meaning to three long-run relationships in a large system based on purely statistical criteria. Using for example the Johansen or Phillips approach would hardly be sensible in the context of our structural exercise. We therefore opt for a VAR in first differences as the more meaningful estimation strategy. Note, moreover, that cointegration is of less importance when the focus is mainly on isolating shocks and not on parameter estimation. Nevertheless, in order to check if the estimations carried out using first differences were robust, we estimated a VECM with three cointegrating vectors. The results indicate that the relative magnitude of the shocks to the different components of real GDP are very similar to those derived from the VAR in first differences; only the absolute magnitude of the shocks are smaller when the VECM strategy is implemented. Note that all interpretations in this paper are based exclusively on the relative magnitude of the shocks.

Table 1. Unit Root Tests

Variable	ADF	PP	Specification
Private consumption	–1.97	–2.32	c, t, 4 lags
Private nonresidential investment	–2.03	–1.43	c, t, 2 lags
Private residential investment	–2.00	–2.24	c, 4 lags
Exports	–3.30	–3.03	c, t, 4 lags
Imports	–3.00	–1.78	c, t, 3 lags
Public consumption	–1.99	–1.80	c, 2 lags
Public investment	–2.16	–1.98	c, t, 1 lag
Inventory ratio	–3.98*	–6.60**	c, t, 2 lags
Real household wealth	–0.81	–0.94	c, 2 lags
Fiscal balance ratio	–7.54**	–0.26	c, t, 3 lags
Real interest rate	–2.91**	–5.65**	4 lags

Note: ADF and PP tests stand respectively for Augmented Dickey Fuller and Phillips Perron tests. Specification mentions the best specification possible based on the residual properties (tested using the Ljung-Box Q statistic). C stands for constant, t for trend. **(*) indicates that the unit root test is rejected at the 1 percent (5 percent) significance level.

The problem with focusing on the estimated residuals of the VAR system is that they do not represent the "true" shocks to each of the expenditure components. VAR residuals, as is well known, are generally correlated across equations, because of their joint dependence on common underlying trends and also owing to the direct contemporaneous dependence of the variables on each other. To get a measure of the structurally uncorrelated shocks to each of the demand components—i.e., to make a reliable judgment about how much the behavior of any given variable has truly changed in relation to the performance that can be expected on the basis of past behavior—we need some identifying restrictions.

Two identifying restrictions are used to recover the structural shocks from the estimated residuals.[5] First, it is assumed that within each quarter, the residuals of the VAR equations are related to each other only through their common dependence on activity. For example, it is assumed that the residuals of the private consumption equation depend on private fixed investment residuals only through their common dependence on GDP (common trend). While this assumption is somewhat restrictive, it is not unduly so, since the feedback effects among these variables tend to take longer than a quarter to occur. The second identifying assumption is that public consumption and gross exports are contemporaneously exogenous, and hence can be used as instruments for GDP.[6]

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[5]The two identifying assumptions adopted imply that there are 44 restrictions in total. Note that to identify the system at least 28 restrictions are needed. See appendix for more details.

[6]Block exogeneity tests do not reject the hypothesis that both public consumption and exports Granger cause the rest of macroeconomic system. The estimated chi-square test for the joint exclusion of public consumption and exports is 30.39, which is significant at the 1 percent level. Moreover, single equation tests carried out separately for each of the expenditure components are all consistent with the assumption of the exogeneity of public consumption and exports to the other expenditure components.

By imposing these identifying restrictions on the baseline VAR, we can purge the residuals of each of the expenditure components of shocks originating from the other expenditure components. For instance, one way of purging private consumption residuals of shocks originating from the other expenditure components is by regressing the residuals of the private consumption equation on the residuals of the auxiliary GDP equation. However, this cannot be accomplished directly given the simultaneity bias arising from the first identifying restriction. Hence, we use the estimated residuals of public consumption and exports to create an instrument for the GDP residuals. In order to be able to make relative comparisons, such as, for instance, the observation that shocks to private fixed investment in Japan have been larger than shocks to private consumption in the 1990s, we normalize these shocks by their respective standard deviations. The impact that the different shocks have on overall activity will of course be a function of the relative weights of the respective components of the national accounts system.

II. Results of the Baseline VAR

The results of the baseline VAR, based on the national accounts expenditure variables, are reported in Table 2. These shocks are computed on the basis of the procedure outlined above. Each observation in the table represents the cumulative sum of shocks from the given starting date (and expressed as a ratio of the respective standard deviations).[7] We choose 1990:02 as the benchmark for cumulating the shocks since it marks the point at which equity prices began to fall in Japan. Choosing 1991:02, the point at which property prices began to collapse, as an alternative starting point for cumulating the shocks does not qualitatively change the results. Since the table reports the cumulative shocks, it should be borne in mind that a decline, for instance, in the level of the positive shocks from one quarter to the next should be interpreted as a negative shock in that latter quarter. And a negative shock simply indicates that the value taken by any variable in a given period is less than what would be predicted on the basis of the past performance of that variable and the past performance of every other variable in the VAR system.

A notable feature that can be observed from the results of the baseline VAR is that the cumulative buildup of negative shocks to private consumption in Japan has been relatively small during the 1990s. The negative shocks to private consumption that do appear in the immediate aftermath of the collapse of equity prices tend to dissipate toward the end of 1994. The negative shocks reappear in 1996, but are never very large thereafter.

There is, however, a large buildup of negative shocks to both private residential fixed investment and private nonresidential fixed investment by the end of 1993; in the case of the latter, they are almost six times larger than the negative

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[7]We normalize the shocks by the standard deviation of the "own" shocks rather than the standard deviation of the GDP shocks, as this procedure allows us to make more meaningful comparisons about the extent to which the deviation of any one expenditure component from past relationships is bigger or smaller than those of the other expenditure components.

Table 2. Baseline VAR Shocks

	Private Consumption	Private Residential Investment	Private Nonresidential Investment	Public Investment	Trade Balance	Public Consumption	Inventories
90:02	0.05	−0.28	−1.05	0.80	0.43	0.53	1.60
90:04	−2.57	−0.04	−0.38	0.54	2.82	0.20	1.78
91:02	−2.47	−1.67	−1.44	2.13	2.90	−1.44	2.11
91:04	−1.17	−3.96	−1.87	2.83	1.85	−1.22	3.32
92:02	−0.67	−4.18	−3.28	3.96	2.60	−4.25	2.31
92:04	−2.20	−5.15	−4.24	4.94	3.37	−3.71	2.30
93:02	−2.12	−6.02	−6.10	5.34	3.70	−5.01	3.24
93:04	−1.07	−4.39	−6.38	5.50	2.09	−6.84	2.22
94:02	−1.70	−3.56	−5.14	4.31	2.54	−7.24	1.61
94:04	−0.78	−4.34	−4.58	2.81	2.02	−6.92	0.63
95:02	−1.57	−5.33	−1.04	1.89	1.01	−5.87	−0.57
95:04	−0.56	−5.52	−0.77	4.24	−0.63	−5.82	−2.21
96:02	−3.33	−5.23	−2.54	7.06	0.47	−6.33	−1.63
96:04	−3.32	−3.87	−1.06	2.77	1.73	−6.60	−2.29
97:02	−2.01	−5.94	−0.05	2.19	2.53	−7.18	−5.36
97:04	−3.37	−8.50	2.15	1.49	2.52	−7.28	−6.11
98:02	−1.52	−7.26	0.07	0.93	1.79	−8.69	−8.33

Note: Each observation in the table represents the cumulative sum of the orthogonalized shocks from 1990:02, expressed as a ratio to the standard deviation of the respective shocks.

shocks to private consumption at around this time. The negative shocks to residential investment tend to persist and become very large by the end of 1997. While negative shocks to nonresidential investment tend to dissipate from 1995 onwards, this process is never very smooth, and sizable negative shocks reappear periodically during the interim.

The buildup of positive shocks to the trade balance up until the second quarter of 1993 reported in Table 2 suggests that the external sector in Japan did not act as a dampener on activity during this period despite the significant appreciation of the exchange value of the yen. However, the dissipation of the positive shocks to the trade balance by end-1995 and the reappearance of mild positive shocks toward the end of 1997 appear to be consistent with the continued appreciation of the yen up until mid-1995 and its sharp depreciation thereafter.

There are large positive shocks to public investment in the 1990s. These correspond in their timing, as can be expected, with the implementation of the various fiscal stimulus packages that were weighted heavily in favor of public investment. Table 2 shows a buildup of very large negative shocks to public consumption by the second half of 1994. These negative shocks persist and become even larger by the second quarter of 1998. The potential dampening effects of trends in public consumption on activity in the 1990s have rarely been discussed in the literature. Are these particular results therefore just a quirk of the estimation process adopted in the paper, or is there an underlying significance to the large negative shocks to public consumption? This issue, as well as intuitive explanations for the observed pattern of shocks to the other expenditure components, is discussed below.

The absence of large negative shocks to private consumption does indeed pose something of a puzzle at first pass. The asset price collapse in Japan during the 1990s was sizable. Equity prices fell by about 60 percent from their peak levels by the middle of 1992 and have not recovered significantly since then. And land prices in the six largest Japanese cities fell by a similar magnitude during the course of the 1990s. These declines in asset prices in Japan were significantly greater than those observed, for example, in Sweden and the United Kingdom, which had themselves experienced sizable declines in asset prices in the early 1990s. Figure 1 illustrates the contrasting experiences among these countries rather clearly. The private savings ratio in Japan stayed relatively stable following the collapse in asset prices, whereas this ratio rose by almost 12 percentage points over the course of two years in Sweden, as private consumption was pruned drastically.

How then does one explain the relatively small negative shocks to private consumption derived from the VAR estimations? First, households in Japan hold just about 5 percent of their total financial assets in the form of equities, and furthermore, the proportion of the listed equities held by the household sector has been declining ever since the mid-1980s.[8] Consequently, the impact of the boom-bust cycle in equity prices on private consumption in Japan can be expected to be smaller than in countries where households are significant

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[8]See the various issues of the Annual Securities Statistics of the Tokyo Stock Exchange.

Figure 1. Personal Savings in Selected Countries
(in percent of disposable income)
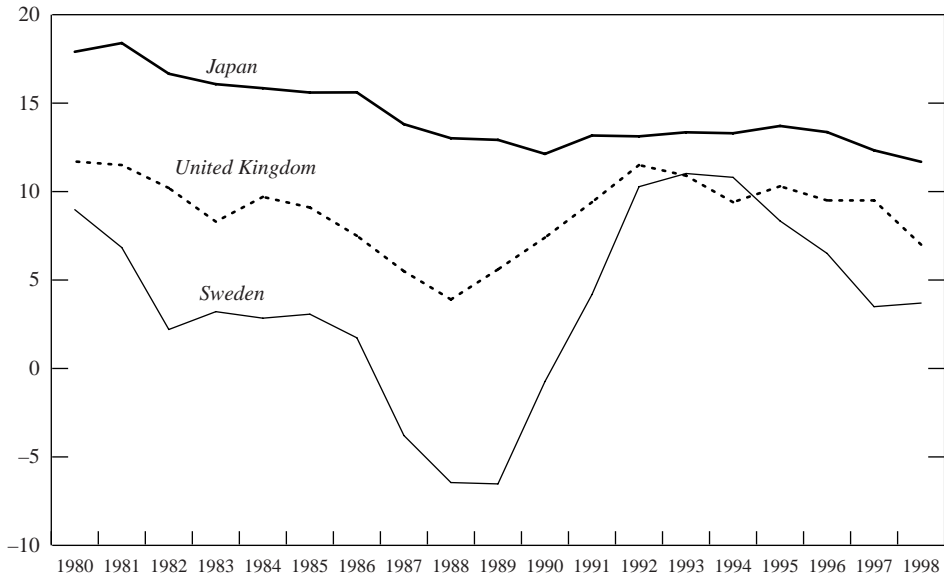
Source: World Economic Outlook database.

owners of equity.[9] Moreover, Japan did not experience any significant increase in unemployment until the beginning of 1998. As a result, households in Japan most likely did not experience the pressing need to increase precautionary savings normally associated with periods of rising unemployment, as had been observed in Sweden for example.[10] A possible scenario is that, looking ahead, if unemployment does increase significantly, negative shocks to private consumption are likely as precautionary factors start coming into play. The impact of changes in property prices on private consumption will, likewise, also be a function of the institutional features of the housing market. While home-owners gain from rising property prices, non-home-owners simultaneously face potential opportunity costs as possible future owners of property. Home owner-ship in the six largest Japanese cities is roughly about 50 percent, a much lower percentage than in countries such as the United Kingdom and the United States. Consequently, the effects of the boom-bust cycle in property prices on private consumption is likely to be more muted in Japan than in countries where home ownership is proportionately larger. Other special features of the housing market in Japan, such as the asymmetry in the treatment of capital gains and inheritance taxes on property (land holdings provide a favorable tax shelter in

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[9]The impact of wealth effects arising from equity price movements on private consumption has been estimated to be relatively small even in the case of the United States. See, for instance, the discussions in Poterba and Samwick (1995), and Staff-McCluer (1998).

[10]See Carroll (1992) for a detailed discussion of issues pertaining to precautionary savings.

the inheritance tax system, but are taxed heavily in the capital gains tax system), as well as the very high absolute levels of property prices, tend to render the housing market particularly illiquid, and dampen potential wealth effects.[11] Putting it all together, the relatively small negative shocks to private consumption derived from the VAR are indeed consistent with what could be expected given the specific institutional features of asset and labor markets in Japan.

The large negative shocks to both private nonresidential fixed investment and private residential fixed investment fit in rather well with conjectures about the unwinding, in the 1990s, of the "overinvestment" of the latter half of the 1980s. The ratio of private gross fixed investment to GDP, for instance, increased by almost 5 percentage points to reach about 25 percent in 1990. Some of the investments undertaken during this period, spurred by a combination of rising asset prices (businesses in Japan own a significant chunk of the listed equities) and the lax lending policies of banks, were in projects that had low returns and high risks. Figure 2 provides some stylized facts regarding trends in investment. The ratio of net business capital to potential output, for instance, increased sharply in relation to trend between 1987–91; despite the prolonged decline in the rate of private investment during the 1990s, this ratio is yet to revert fully back to trend (Figure 2a). An alternative way of evaluating the investment story is in terms of the dynamic efficiency criterion of Abel, Mankiw, Summers, and Zekhauser (1989), which compares the relationship between additions to capital and the returns to it. The narrowing of the gap between capital income and the rate of investment in the latter half of the 1980s and its subsequent widening following the decline in the rate of investment in the 1990s are again consistent with the hypothesis that the cost of the overinvestment (and declining returns to capital) in the latter half of the 1980s had to be its unwinding in the 1990s (Figure 2b).

As noted earlier, the large negative shocks to public consumption pose something of a puzzle. However, a closer look at fiscal developments in Japan from a historical perspective does provide a convincing story consistent with the results of the VAR estimations. The central government in Japan operated an implicit "golden rule"—i.e., fiscal deficits to be no higher than the value of public investment undertaken by the central government—up until 1975.[12] With the size of the fiscal deficits growing larger by the end of the 1970s, the central government abandoned the golden rule and funded deficits with both construction bonds (i.e., bonds issued to finance investment projects undertaken by the central government), as well as deficit financing bonds (i.e., bonds issued to finance current expenditures). The golden rule was reinstated once again during the early 1990s, with only construction bonds being issued in this period. Consequently, there was an institutional bias in favor of public investment, and against public consumption, in the early 1990s. While deficit financing bonds began to be issued from 1993 onwards, the fiscal stimulus packages during 1993–98 persisted with the emphasis on public investment. A likely reason for the emphasis placed on public

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[11]For a more detailed discussion of these issues, see Ito (1992), and Nishimura, Yamazaki, Idee, and Watanabe (1998).

[12]For a more detailed discussion, see Bayoumi (1998b), and Ishi (1996).

Figure 2. Japan: Business Capital-to-Output Ratio and Efficiency of Investment

Ratio of Net Business Capital to Potential GDP[1]

Efficiency of Investment
(in percent of GDP)
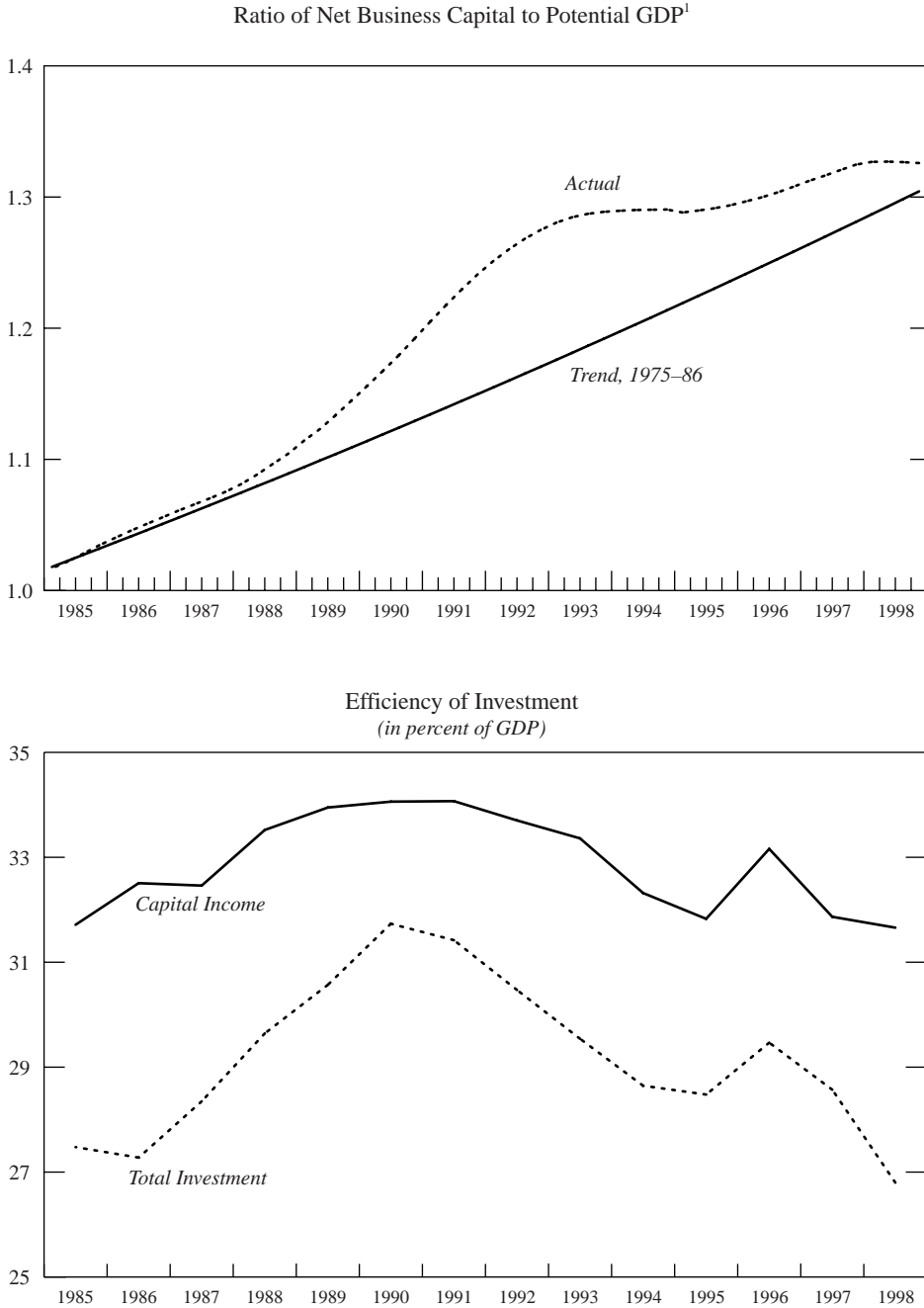
Sources: OECD and NIKKEI telecom.
[1]Potential GDP is generated using a production function approach.

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investment in the fiscal packages in Japan is that construction projects can be used as one-off stimulatory measures. In contrast, once a commitment has been made to increase public consumption, it is more difficult to reverse it at a later stage. Thus, when viewed solely as a tool of countercyclical fiscal policy, spending programs that focus on public investment provide governments with greater flexibility than ones that place emphasis on public consumption. A trend that appears to have gone relatively unnoticed in much of recent analyses on Japan is that, as a consequence of the particular policy choices that were adopted in the fiscal arena, the average growth of public consumption in the 1990s declined significantly in relation to its trend growth between 1973–90, whereas public investment grew on average in the 1990s at about twice the pace of the previous period (Figure 3). And given that public consumption constitutes roughly the same share of overall output that public investment does, the impact of the negative shocks to public consumption is likely to have broadly offset the positive shocks to public investment in the 1990s.[13]

III. Policy-Augmented VAR

The baseline VAR provides a useful framework for understanding the precise manner in which deviations in the pattern of expenditure components from past trends contributed to the dampening of activity in the 1990s. However, the changes in the behavior of economic agents during this period did not occur in a vacuum. Both monetary and fiscal policies were used actively in Japan during the 1990s to influence the course of economic developments. In the case of monetary policy, the official discount rate (ODR) was lowered from 6 percent in mid-1991 to about $1^3/_4$ percent by end-1993. As activity continued to be weak through 1994, the ODR was lowered sharply to $^1/_2$ percent by end-1995, a level at which it has remained since then. The Bank of Japan eased monetary conditions further recently by lowering its operating target for the overnight call rate to 0.25 percent in September 1998, and to "as low as possible" in February 1999. In the case of fiscal policy, there has been at least one major stimulus package every year since 1992, except in 1997, when fiscal policy turned contractionary with the implementation of cuts in public works spending and the increase in the consumption tax.

How does one judge whether the monetary and fiscal policies pursued during this period were successful or not? The fact that economic activity continued to stagnate in the 1990s is not necessarily an indication of the failure of policies. The counterfactual scenario could clearly be one in which economic conditions in Japan would have been even more dismal had the expansionary monetary and fiscal policies not been undertaken. How then can such a counterfactual hypothesis be verified empirically? The VAR approach has both a limitation and an advantage for evaluating the counterfactual hypothesis about the effectiveness of policies. The main limitation is that one is attempting to draw structural inferences

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[13]The contribution of public consumption to growth in the 1990s was, on average, about half that of the contribution between 1973–90. In contrast, the contribution of public investment to growth in the 1990s was, on average, twice that of the contribution in the earlier period.

Figure 3. Japan: Public Consumption and Public Investment
(percent change)
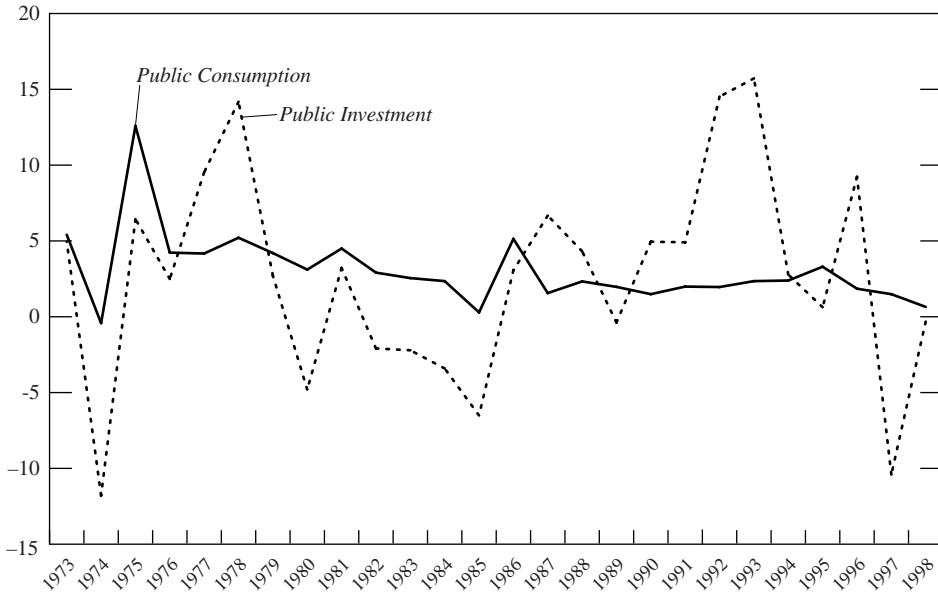
Sources: Nikkei Telecom, WEFA, and IMF staff estimates.

from what is, despite the identifying restrictions adopted, essentially a nonstructural exercise. The advantage of the VAR methodology, however, is that because of its focus on innovations (or shocks, once recovered from the estimated residuals) it provides a convenient metric for estimating how the shocks would have evolved once monetary and fiscal policies are incorporated as part of a policy-augmented VAR.

How can monetary and fiscal policies be proxied in the case of Japan and how do they enter into the VAR for evaluating the counterfactual scenario? The operating instrument for monetary policy that has traditionally been used in Japan is the official discount rate. More recently, the Bank of Japan has used the overnight call rate as its main monetary policy instrument. The stance of monetary policy over longer time spans can be captured by using either a smoothed version of the overnight call rate (as the call rate exhibits volatility on a day-to-day basis owing to demand shocks for overnight funds), or the three-month CD rate. The time series properties of these two series are pretty much the same. To capture the impact of changes in monetary policy on activity, we use a real interest rate, defined as the three-month CD rate minus consumer price inflation.[14]

Getting a proxy for fiscal policy turns out to be more complicated in the case of Japan. Both public investment and public consumption, which have been used to varying degrees as tools of fiscal policy, are already in the baseline VAR. One

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[14]Using the GDP deflator rather than the consumer price inflation to calculate real interest rates does not make a difference to the results.

way of getting an appropriate variable to represent the additional discretionary fiscal effects in a policy-augmented VAR is to strip out both public investment and public consumption from the general government balance. To capture the effects of discretionary fiscal policy, we then take the ratio of the "trend" of the adjusted general government balance to "trend" GDP.[15] (It should be noted that using the nonadjusted general government balance instead in the estimations does not change the results of the VAR qualitatively.) The policy-augmented VAR also incorporates the net worth of the household sector as a ratio of GDP to capture the impact of potential wealth effects. The monetary, fiscal, and household wealth variables are entered as exogenous variables in the enlarged system.[16]

How do we evaluate the counterfactual scenario about the effectiveness of policies in terms of the pattern of shocks recovered from the policy-augmented VAR? An intuitive way of trying to make sense of this question is to consider the hypothetical scenario in which the slump in activity during a given period coincides with the implementation of contractionary monetary and fiscal policies. Negative shocks derived from a baseline expenditure-based VAR should disappear, or at least decline significantly in the policy-augmented VAR, if the slump in activity was precipitated by the implementation of these contractionary policies. In the case of Japan, the scenario being considered is obviously the obverse. The slump in activity coincides in timing with a significant easing of monetary and fiscal policies. In order for the counterfactual hypothesis—i.e., that the slump in activity would have been even more severe in the absence of the expansionary monetary and fiscal policies pursued—to be true, the negative shocks of the baseline VAR should become even more negative in the policy-augmented VAR. The intuition for using this metric as a test of the counterfactual is that, once past relationships between activity and policies are incorporated into the estimation process, the deviation of activity from historical relationships in the policy-augmented VAR should be more severe than it is in the baseline VAR. Correspondingly, if the shocks recovered from the enlarged VAR do not become more negative, or in fact become less negative, then these results are consistent with the hypothesis that the slump in activity would not have been much worse in the absence of the actual monetary and fiscal policies that were pursued.

Table 3 reports the results from estimations of the policy-augmented VAR. (The estimations stop in 1997:Q1 because of lags in the availability of data on the general government's fiscal balance.) The structural shocks are obtained using the same identifying restrictions as in the baseline VAR. It can be seen that the shocks to private consumption in this VAR are not very different from those in the baseline VAR. The fact that these results are consistent with the hypothesis that policies had little impact on private consumption during the 1990s should not come as much of a puzzle. As argued previously, wealth effects in Japan are likely to have

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[15]The "trend" components of both the general government balance and GDP are calculated using the Hodrick-Prescott filter.

[16]Block exogeneity tests do not reject the hypothesis that these variables Granger cause the rest of the system. The estimated chi-square test for the joint exclusion of these variables is 131.48, which is significant at the 1 percent level. When the policy variables are included as endogenous variables, the results of the policy-augmented VAR do not change much.

Table 3. Enlarged VAR Shocks
(exogenous variables: real interest rates, household wealth, fiscal balance)

	Private Consumption	Private Residential Investment	Private Nonresidential Investment	Public Investment	Trade Balance	Public Consumption	Inventories
90:02	−0.08	−0.21	−1.35	0.27	0.53	0.39	1.72
90:04	−2.04	0.89	−2.40	0.94	2.33	1.46	3.28
91:02	−2.25	−1.07	−3.32	1.56	2.97	0.22	3.62
91:04	−0.30	−4.33	−3.38	1.75	1.21	0.57	4.31
92:02	−0.53	−4.97	−3.81	1.25	3.10	−1.98	2.65
92:04	−1.46	−6.39	−3.88	1.38	2.93	−1.96	2.10
93:02	−1.15	−8.30	−4.86	1.15	3.34	−4.14	2.20
93:04	−0.88	−6.88	−4.74	0.57	3.09	−4.71	0.48
94:02	−1.25	−5.54	−4.15	0.19	3.37	−4.55	−0.06
94:04	−0.97	−6.39	−2.76	−2.13	3.21	−3.80	−1.84
95:02	−1.87	−7.27	1.42	−4.00	1.74	−2.70	−4.03
95:04	−1.28	−7.26	1.60	−2.15	0.23	−2.94	−5.95
96:02	−3.77	−6.69	−1.22	1.25	0.86	−3.27	−4.60
96:04	−3.10	−4.96	0.24	−2.21	1.63	−2.92	−5.45
97:01	1.22	−5.85	−1.14	−1.74	0.85	−2.63	−4.93

Note: Each observation in the table represents the cumulative sum of the orthogonalized shocks from 1990:02, expressed as a ratio to the standard deviation of the respective shocks.

Table 4. Enlarged VAR Shocks

(exogenous variables: real interest rates, household wealth)

	Private Consumption	Private Residential Investment	Private Nonresidential Investment	Public Investment	Trade Balance	Public Consumption	Inventories
90:02	-0.01	-0.39	-1.06	0.00	0.82	0.54	1.89
90:04	-2.05	0.36	-1.40	0.05	2.93	1.48	3.33
91:02	-2.21	-1.44	-2.78	1.08	3.45	0.33	3.85
91:04	0.10	-4.42	-3.44	2.00	1.78	1.26	4.96
92:02	-0.11	-4.69	-4.79	2.11	3.30	-1.24	3.33
92:04	-0.53	-5.49	-6.42	3.84	3.05	-0.40	3.57
93:02	0.07	-6.98	-8.56	4.55	3.33	-2.06	4.20
93:04	0.15	-5.54	-8.61	4.02	2.86	-2.93	2.44
94:02	-0.48	-4.45	-7.34	2.96	3.09	-3.25	1.51
94:04	-0.25	-5.05	-6.65	0.98	2.60	-2.63	0.08
95:02	-1.12	-5.67	-3.00	-0.24	0.86	-1.49	-1.61
95:04	-0.63	-5.68	-2.90	2.08	-0.76	-1.89	-3.64
96:02	-3.27	-5.51	-5.06	5.27	0.13	-2.46	-2.48
96:04	-2.84	-3.90	-3.23	0.95	0.77	-2.54	-3.42
97:01	1.52	-5.04	-4.10	0.95	0.33	-2.10	-3.19

Note: Each observation in the table represents the cumulative sum of the orthogonalized shocks from 1990:02, expressed as a ratio to the standard deviation of the respective shocks.

been small. And banks played only a limited role in extending consumer credit against collateral to households. Consequently, one would expect the response of private consumption to changes in monetary policy to be small, as borne out by the results of the policy-augmented VAR. The apparent failure of fiscal policy to stimulate private consumption can also be explained. As noted earlier, the fiscal stimulus packages were weighed heavily in favor of public works projects and measures to support land purchases. Moreover, the tax reductions incorporated in the fiscal packages have mostly tended to be temporary in duration, and ad hoc in conception, a combination that is unlikely to prove effective in stimulating private consumption.

It can also be seen from Table 3 that the shocks to private residential fixed investment do not change much up until 1992:Q2 in the policy-augmented VAR when compared to the baseline estimations, but then become visibly more negative thereafter. Shocks to private nonresidential fixed investment, in contrast, become more negative up until 1992:Q2, but then become less negative thereafter. This would imply that while private residential investment did respond positively to the fiscal stimulus packages, nonresidential investment did not. The fact that the shocks to private residential investment get more negative precisely during the period when the fiscal stimulus packages, with their emphasis on construction projects, land purchases, and subsidized loans for investments in residential property, are implemented in earnest argues in favor of a positive relationship between the stimulus packages and residential investment. In contrast, one would not expect, on a priori grounds, a strong relationship to exist between fiscal stimulus and nonresidential investment, particularly if the negative shocks to private nonresidential investment partly reflect the necessary unwinding in the 1990s of the overinvestment in the 1980s. These arguments find support in an experiment in which the fiscal policy variable is dropped from the enlarged VAR. As can be seen from Table 4, the shocks to private residential investment revert back to the levels of the baseline VAR. In contrast, the shocks to private nonresidential investment become larger, suggesting that while such investment does not respond to fiscal stimulus, it does to changes in monetary policy.

Thus, while the results of the policy-augmented VAR are consistent with the conjecture that activity would not have been significantly weaker in the absence of the discretionary fiscal policies that were actually pursued in the nineties, this does not necessarily constitute an argument about the ineffectiveness of policies in general in the Japanese context. It is conceivable that fiscal policy could have been more successful in stimulating the economy had it been implemented in a less ad hoc manner and concentrated more on measures that could have had a more direct and longer-lasting impact on activity.

IV. Conclusion

This paper has provided a framework for identifying the driving forces of the slow growth in Japan during the 1990s. Large negative shocks to both private residential investment and private nonresidential investment have been shown to be the principal factors dampening activity during the 1990s. The negative shocks to

private investment essentially reflected the unwinding in the 1990s of the overin-vestment that took place in the latter half of the 1980s. Negative shocks to public consumption also contributed to the slowdown of activity. Despite the severe collapse of asset prices in the nineties, negative shocks to private consumption proved to be relatively small, reflecting most likely the low ownership of equities by households and the lack of urgency to increase precautionary savings owing to the low levels of unemployment in Japan. The external sector did not act as a major dampener on activity despite the significant appreciation of the yen in the first half of the 1990s. These VAR estimations do not lend support to the counter-factual conjecture that activity would have been significantly weaker in the absence of the expansionary shift in the stance of fiscal policy. The relative inef-fectiveness of fiscal policy in Japan during the 1990s is likely to be related to the shortcomings in the design and implementation of the stimulus measures.

Appendix

The VAR Model

The estimated VAR model has the following structure:

$$\Delta Y_t = C + \sum_{L=1}^{2} \theta(L) \Delta Y_{t-L} + U_t \tag{1}$$

$$Y_t = \begin{bmatrix} Priv.\ C_t \\ Priv.\ Nonres.\ I_t \\ Priv.\ Res.\ I_t \\ Public\ I_t \\ Public\ C_t \\ Exports_t \\ Imports_t \\ Inventories_t \end{bmatrix},\ C_i = \begin{bmatrix} C_1 \\ .. \\ .. \\ C_i \\ .. \\ .. \\ .. \\ C_8 \end{bmatrix},\ \theta_{ij}(L) = \begin{bmatrix} \theta_{11}(L)\ \theta_{12}(L)\ ..\ ..\ ..\ ..\ \theta_{18}(L) \\ .. & .. \\ .. & .. \\ .. & \theta_{ij}(L) & .. \\ .. & .. \\ .. & .. \\ .. & .. \\ \theta_{81}(L)\ ..\ ..\ ..\ ..\ ..\ ..\ \theta_{88}(L) \end{bmatrix}$$

$$U_{it} = \begin{bmatrix} U_{it} \\ .. \\ .. \\ .. \\ .. \\ .. \\ .. \\ U_{8t} \end{bmatrix},\ \text{and}\ U_{it}\ \text{is}\ N(0, \sigma_i^2).$$

After estimation, U_{it} is the vector of residuals. GDP is derived as an auxiliary equation given that it is the sum of the components in the VAR. The GDP residuals are the weighted average of the residuals to the expenditure components. However, these residuals cannot be given any structural interpretation, and we need to recover the structural shocks. For this we use two identifying restrictions, which are explained below.

Structural Shocks

The identification scheme is based on a simple Keynesian model. It is assumed that each element of the residual vector is driven by a single common trend (an income trend), and an idiosyncratic component (the structural shock). Therefore, in the case of private consumption (pc), for instance, the structural private consumption shock corresponds to the residual ε_{pc} of the following regression:

$$U_{pc,t} = \alpha + \beta \cdot \hat{U}_{gdp,t} + \varepsilon_{pc,t}$$
$$\varepsilon_{pc} \text{ is } N(0, \ \sigma_{oc}^2). \tag{2}$$

U_{pc} is the reduced form residual obtained from the estimation of (1). Note that, due to simultaneity problems, we cannot use U_{gdp} directly. $\hat{U}_{gdp}$ is an instrumental variable for U_{gdp}, which stands for the fitted values of the following regression:

$$U_{gdp,t} = \beta_0 + \beta_1 \cdot U_{puc,t} + \beta_2 \cdot U_{x,t} + e_{0,t}$$
$$e_0 \text{ is } N(0, \ \sigma_0^2), \tag{3}$$

where U_{gdp}, U_{puc}, and U_c are the reduced form residuals for GDP, public consumption, and exports estimated from (1).

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