CAPITAL INVESTMENT, INTERNATIONAL TRADE AND ECONOMIC GROWTH IN CHINA: EVIDENCE IN THE 1980–90s

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ABSTRACT: This paper demonstrates that fixed-capital investment and merchandise exports are two important determinants of China's economic growth in the 1980-90s. Changes in fixed-capital investment unidirectionally caused growth in industrial output and its sub-categories. Similar one-way causal relations existed between exports and industrial output and its sub-categories. However, no such causal relation was found between imports and output. These findings suggest that China follows an investment-driven expansion path; China's export-oriented trade strategy enhances economic growth; and the import-permitting regime has no contribution to economic performance. *JEL Classification Numbers: F14, F43, and O53.*

I. INTRODUCTION

Since market-oriented reforms starting in 1978, China has experienced an exceptional economic expansion with two-digit average annual GNP growth. This extraordinary economic performance rivals the records of Japan and the East-Asian newly industrialized economies beginning in the late 1960s, where the economic growth was largely attributed to capital accumulation and export explosion.

China's progressive reforms have fundamentally changed the economic structure through introducing the market mechanism into the rigid central planning system. One of the most important systematic innovations is to decentralize the economic-decision power from the central government to local authorities and production agents. The progress of decentralization has significantly ignited expansion incentive, resulting in a large scale of fixed-capital investment in the 1980–90s. For instance, fixed-capital investment relative to GNP rose from 19.77 percent in 1981 to 37.80 percent in 1993. Over the period of 1981–94, the annual average GNP growth rate was 10.2 percent, but the annual average rate of fixed-capital investment growth recorded 25.5 percent. Like earlier East Asian NICs, fixed-capital investment expansion is one to two times higher than output growth. This phenomenon suggests that China's economic expansion may be due largely to investment acceleration.

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On the other hand, the open-door development strategy, together with preferential polices for outward-looking industries, has vigorously promoted China's foreign trade. For example, the value of foreign trade in 1992 was 26 times larger than in 1978, and the value of foreign trade relative to GNP rose from 9.9 percent in 1978 to 38 percent in 1992. In 1993 alone, the total value of merchandise exports and imports amounted to US$ 195.7 billion, which ranks China the eleventh largest trading economy in the world. Strong trade performance may partially explain China's impressive growth.

How do China's investment and trade relate to its economic growth? Does China's expansion follow an investment-driven and trade-led growth path, like the experiences of other East-Asian economies? What are the impacts of investment and trade on different sectors and owners? How do the export-promoting development strategy and import-permitting regime work? Recent literature has explored these questions. Among these studies, Chow (1993) employed annual data to analyze the effect of investment on output during 1952–1980 and stressed the importance of investment in the Chinese economy. Yusuf (1994) and Perkins (1994) reviewed the roles of investment and foreign trade in China's macroeconomic performance. Krugman (1994) argued that growth of the East-Asian economies, including China, was input-driven. However, we lack sufficient empirical evidence to verify the roles of investment and trade in China's economic expansion over the last two decades.

The objective of this paper is to study the nexus between investment, trade and industrial output since the start of economic reforms. The structure of this paper is as follows. Section II briefly reviews structural changes in investment and trade systems during reform. Section III describes the data set used in this study. Section IV analyzes the long-run stable relationship between investment, trade and output. Section V tests the dynamic effects of investment and trade on industrial output. Finally, section VI summarizes.

II. STRUCTURAL CHANGES IN CHINA'S INVESTMENT AND TRADE SYSTEMS

Before 1978, the Soviet-style central planning system dominated China's economy. Within this framework, the central government formulated a comprehensive physical production plan, with direct allotment of material and capital resources. Accordingly, investment was tightly dictated by the authorities. Since the late 1970s, reforms have gradually decentralized economic decision-making power from the central government to local authorities and production agents. Consequently, localities have acted as both investment decision-makers and major investors. The initial design of decentralization was to stimulate production incentives so as to improve economic efficiency, but its evolution has far-reaching effects on the economy, including the investment structure.

Over the past two decades, markets have developed, expanded and played an increasingly important role in commodity allocation.[1] Meanwhile, the central government still directly allots capital resources through bank credit planning and interest rate control. This direct loan allocation favors the state sectors, regardless of credit risk and profitability. In 1978–92, the state sectors received over 80 percent of bank credits, even though their contribution to GNP kept declining. This practice reflects the government's deep concern about political and social costs of bankruptcy and unemployment which may result from

abandoning the traditional capital allocation system. Economically, however, it perpetuates moral hazard problem and soft-budget constraint for the state sector.

As a result, local governments and the state owned enterprises (SOEs) strongly inflate fixed-capital investment. In practice, they recognize that increase in fixed-capital investment is a major way of competing away resources from the central government and generating potential revenue. In addition, the state sector and local governments have easy access to funds as the banking system took over fund provisions for investment in the early 1980s and financial markets were introduced in the mid-1980s. Hence, the share of the central-government determined investment in overall fixed-capital investment dramatically decreased from 77.7 percent in 1978 to 10.2 percent in 1992. In the mean time, the state fixed-capital investment expanded at the average growth rate of 19.8 percent in 1982-93, and 35.58 percent in the 1990s.

In the traditional Soviet-style planning system, the state monopolized international trade and controlled foreign exchange. In the 1950s and the early 1960s, China's major trading partners were the Soviet Union and East-European countries. When the Sino-USSR allied relation was broken in the 1960s, China adopted a "self-reliance" development strategy and its foreign trade declined to minimal level. In 1966–76, the Cultural Revolution almost phased out China's foreign trade. Since 1978, the open-door development strategy has introduced policies to encourage the growth of outward-looking or export-oriented economic sectors.

Trade-stimulating innovations include the following areas. (1) The exchange-retention regime was introduced in the beginning of the 1980s, which permits commodity-exporting enterprises to retain a proportion of the earned foreign currencies; (2) Special economic zones along the costal provinces were set up in the early 1980s to facilitate foreign investors establishing export processing industries; (3) A dual-track exchange rate system (coexistence of the state-set and market-clearing exchange rates) was adopted in the mid-1980s, together with the establishment of foreign exchange swap centers where enterprises can trade foreign currencies at spot market rates. Later on, the dual exchange rate regime was replaced by a uniform market-determined exchange rate structure, while exchange control still exists; (4) The state monopoly over foreign trade was broken as a large number of regional trading companies were allowed to operate; (5) export-promoting trade policies were implemented to encourage merchandise exports. They include export subsidies which grant tax relief and rebate to exporters, and low-interest loans which provide cheap finance to export-oriented enterprises; and (6) Import tariffs were gradually reduced. Meanwhile, an import license regime associated with quota restrictions was established. Responding to these systematic changes, foreign trade, including both merchandise exports and imports, phenomenally increases and its average growth rate recorded 27.2 percent in 1978–92, and 30 percent in the 1990s.

III. THE DATA

The data used in this study are monthly variables in the *Monthly Statistics of China* published by the State Commission of Statistics of China (SCSC). I use overall industrial output to proxy China's economic performance, because it has accounted for 60-66 percent of gross social product in the Chinese economy since 1980.[2] I also choose four sub-categories of industrial output variables. They include output of the light industrial (labour-intensive)

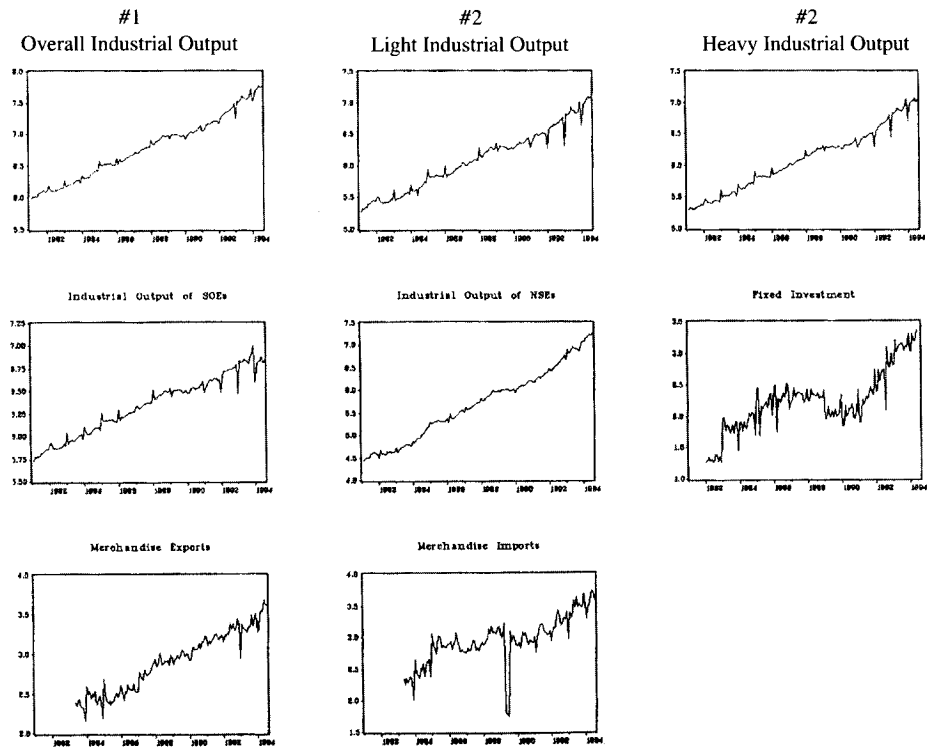

Figure 1
Logarithms of Output, Investment, Exports and Imports

sector, output of the heavy industrial (capital-intensive) sector, output of the state owned enterprises and output of the non-state owned enterprises.[3] Industrial output variables are in real values measured by 1980 constant prices.

The basic reason of using different sub-categories of industrial output in this study is to capture the economic heterogeneity which results from changes of the heavy-industry oriented development strategy and progress of economic marketization. In the 1980s, the labour-intensive sector expanded more rapidly than the capital-intensive sector because of development strategy change. Beginning in the 1990s, the latter has grown faster than the former, due to large-scale investments in bottle-neck infrastructural sectors such as transportation, communication, electricity and public utilities. On the other hand, the non-state owned sector has emerged and proliferated very rapidly since the late 1970s. For example, the contribution of non-state enterprises in overall industrial output increased from 24 percent in 1980 to 51.9 percent 1992.

The data set also contains monthly series of the state fixed-capital investment,[4] merchandise exports and merchandise imports measured by the U.S. dollars. Real value of the state fixed-capital investment is obtained as the nominal term is deflated by the monthly overall retail price index (RPI) published in the *Monthly Statistic of China.* Similarly, real values of exports and imports are obtained as the nominal variables are deflated by the U.S. consumer price index (CPI) series in the *International Financial Statistics.*[5]

Table 1
Integration Tests for Investment, Exports, Imports and Industrial Output

	ADF (with c)	*ADF (with t & c)*	*ADF (with c)*	*ADF (with c & t)*
Level Form:			*First Difference Form:*	
Y1	1.96	–0.32	–5.05***	–5.47***
Y2	2.45	–0.22	–9.15***	–9.63***
Y3	2.33	–0.43	–7.68***	–8.12***
Y4	–1.23	–1.26	–9.09***	–9.16***
Y5	1.60	–1.19	–12.18***	–12.39***
FI	–0.64	–1.27	–5.24***	–5.22***
EX	0.04	–2.19	–7.13***	–7.11***
IM	–1.60	–2.94	–6.97***	–6.94***

Notes: ADF = augmented Dickey-Fuller statistic. Y1 = overall industrial output; Y2 = industrial output of the light-industry sector; Y3 = industrial output of the heavy-industry sector; Y4 = industrial output of state enterprises; Y5 = industrial output of non-state enterprises; FI = fixed-capital investment; EX = merchandise exports; IM = merchandise imports. The critical values are according to McKinnon's statistics.
*** statistically significant at the 1 percent level.

All time-series variables are transformed into logarithmic forms and seasonally adjusted. The diagrams in Figure 1 depict logarithms of industrial output variables in 1981.01–1994.08, fixed-capital investment in 1982.01–1994.08 and foreign trade variables in 1983.05–1994.08, respectively. Notice that a significant dip of fixed-capital investment and merchandise imports in 1989 was due to the political turmoil in that year. Because of the constraint of trade variables, the sample period for the following estimations is from May 1983 to August 1994.

IV. STABLE RELATIONSHIP BETWEEN INVESTMENT, TRADE AND OUTPUT

A statistical diagnosis for the univariate trend properties of time series is a prerequisite to study the nexus between investment, trade and output based on the *growth rates.* The causal relation between them is not spurious only if the levels of the involving variables are integrated of order one, or their growth rates are integrated of order zero. In other words, these time-series variables should be non-stationary in the level forms but stationary in the first differences. This feature is also required to examine existence of a long-run stable relationship between these variables.

To determine the integrating order of the time-series variables, the augmented Dickey-Fuller (ADF) procedure suggested by Dickey and Fuller (1981) is used to test each variable for a unit root in its level, and then in the first difference form. Table 1 presents testing results for all output, investment and trade variables. The first column shows the test statistics with a constant term, while the second column reports the results when the regressions contained both constant term and time trend.[6] Based on the critical values reported by MacKinnon (1990), the null hypothesis of a unit root for each variable in level was not rejected, regardless of the inclusion of time trends in the regressions. That is, all variables are best characterized as integration of degree one. Similarly, the third column reports the test results for first differences with a constant term, and the fourth column presents statistics of first differences when the equations had constant and trend terms. The null hypoth-

Table 2
Engle-Granger's Cointegration Tests for Long-run Relations between Investment, Trade and Industrial Output

Residual Equations:	$\bar{R}^2$	*DW*	*F-stat*	*ADF-stat*
Y1:				
(with c)	0.37	2.00	76.82	–6.84***
(with c & t)	0.38	2.10	81.56	–4.12
Y2:				
(with c)	0.35	2.00	70.41	–6.36***
(with c & t)	0.39	2.01	84.84	–5.53***
Y3:				
(with c)	0.36	2.01	74.90	–6.48***
(with c & t)	0.41	2.06	92.79	–5.08**
Y4:				
(with c)	0.32	1.97	61.81	–4.98***
(with c & t)	0.37	1.97	77.11	–5.02**
Y5:				
(with c)	0.37	1.98	76.53	–7.03***
(with c & t)	0.33	2.18	64.99	–3.32

Notes: ADF = augmented Dickey-Fuller statistic. The critical values are according to McKinnon's statistics (1990).
*** statistically significant at the 1% level;
** statistically significant at the 5 % level. Also see the notes of Table 1.

esis of a unit root for each variable in first differences was significantly rejected at the 0.01 level in both cases, indicating that all first differenced variables are characterized as integration of zero.

As a stochastic trend has been confirmed for each of the series, the observed time-series possess trends which can be removed by first differencing. The question is whether there exists some long-run equilibrium relationship between these variables. A linear combination may exist between two or more economic variables which converge to long-run equilibrium, even though the series tend to move arbitrarily over time. In other words, they are cointegrated when each individual variable demonstrates stationarity only in first differences, but a linear combination of their levels may result in stationarity.

Recent econometric progress has made achievements in cointegration methodology to examine long-run stable relationships between time series. Granger (1986), Engle and Granger (1987) pioneered the area of cointegration tests. They proposed a two-step procedure to identify cointegrating vectors. First, this approach runs an OLS regression on an error correction model (ECM) to produce residuals. Second, it conducts a unit root test for the null hypothesis of no cointegration relationship (they are not stationary) against the alternative of a cointegration relationship between them. According to their theorem, the error correction model can be expressed as:

$$\Delta Y_t = \alpha_1 + \sum_{i=1}^{n} \beta_i \Delta Y_{t-i} + \sum_{i=1}^{n} \gamma_i \Delta I_{t-i} + \sum_{t-i}^{n} \delta_i \Delta X_{t-i} + \sum_{t-i}^{n} \theta_i \Delta M_{t-i} + \lambda_1 \eta_{t-1} + \varepsilon_t \quad (1)$$

where Δ is the first difference operator. Y, I, X, and M are, respectively, logarithmic forms of industrial output, fixed-capital investment, exports and imports, η is the lagged error

Table 3
Johansen-Juselius' Cointegration Tests for Long-run Relations between Investment, Trade and Industrial Output

Null Hypothesis:	$r = 0$	$t \leq 1$	$t \leq 2$	$t \leq 3$
A: Trace Tests:				
Y1	89.83***	6.41	2.36	2.31
Y2	96.12***	6.38	1.67	1.61
Y3	107.63***	6.66	2.15	0.07
Y4	7.88	7.78	1.48	1.40
Y5	39.41***	5.26	1.98	1.92
B: Maximal Eigenvalue Tests:				
Y1	83.42***	4.05	0.05	2.31
Y2	89.75***	4.71	0.06	1.61
Y3	100.97	4.51	2.08	0.07
Y4	0.00	6.30	0.07	1.40
Y5	34.15**	3.28	0.06	1.92

Notes: Eigenvalues for each equation are: Y1: (0.4981, 0.0329, 0.0004, 0.0189); Y2: (0.5237, 0.0382, 0.0005, 0.0132); Y3: (0.5659, 0.0365, 0.0171, 0.0006); Y4: (2.4111, 0.0508, 0.0006, 0.0115): Y5: (0.2459, 0.0267, 0.0005, 0.0158). The critical values for the resulting test statistics are given in Table A2 of Johansen and Juselius (1990). *** statistically significant at the 1% level; ** statistically significant at the 5% level. Also see the notes of Table 1.

term resulting from the cointegration equation: $Y_t = \mu I_t + \sigma X_t + \tau M_t + \eta_t$, and ε is an error term.

But this approach may suffer a bias since the results are subject to arbitrary normalization, and it may also fail to distinguish the number of cointegrating vectors. Alternatively, Johansen (1988), Johansen and Juselius (1990) and Johansen (1991) provided a maximum-likelihood estimation procedure, which simultaneously regresses vector autoregressions to estimate cointegrating vectors. They suggested two likelihood ratio tests for cointegration relations. Based on maximal eigenvalues, the first one tests for the null hypothesis at most r cointegrating vectors against the alternative $r + 1$ vectors. Based on the trace of the stochastic matrix, the second one tests for the null hypothesis at most r cointegrating vectors against the alternative of r or more vectors. This method is capable of identifying multiple cointegrating vectors, and it is also orthogonal to an arbitrary normalization.[7]

For the purpose of comparison, both the Engle-Granger and the Johansen-Juselius procedures are used to test for the null hypothesis of existence of a long-run stable relationship between industrial output, fixed-capital investment and trade in China's context. Table 2 shows the results of the Engle-Granger two-step cointegrating test.[8] According to MacKinnon's critical value, the computed ADF statistics strongly rejected the null hypothesis of a unit root for the regressed residuals. That is, industrial output, fixed-capital investment and trade variables, including all sub-groups of industrial output, are cointegrated. Table 3 presents the testing results from the Johansen-Juselius multivariate cointegrating testing approach based on maximum-likelihood method. According to the critical values reported by Johansen and Juselius (1990), both maximal-eigenvalue test statistics and trace test statistics provided significant evidence for the existence of a cointegrating relationship between the overall industrial output, investment and trade variables. The results also support the hypothesis that there exists cointegrating relations between sub-grouped industrial

Table 4
Significance Tests of Investment, Exports and Imports for Industrial Output in ECMs

	ΔY1	*ΔY2*	*ΔY3*	*ΔY4*	*ΔY5*
ΔFI	3.6900***	3.9216***	3.0165***	2.4831***	3.6545***
ΔEX	2.8958**	2.2569**	2.5871***	2.2709**	2.6541***
ΔIM	0.4292	0.3772	0.4854	0.2536	1.1803

Notes: Estimations use 12 lags of each variable; *** statistically significant at the 1% level; ** statistically significant at the 5% level; * statistically significant at the 10 % level.

Table 5
Significance Tests of Industrial Output and Imports
for Investment and Trade Variables in ECMs

	ΔFI	*ΔEX*	*ΔIM*
ΔY1	1.7111	1.3125	0.6498
ΔIM	0.1741	0.7671	

Note: see the notes of Table 1.

output, investment, and trade variables. In fact, the results obtained are much less clear-cut, but they are similar to many studies using the Johansen-Juselius procedure.[9]

V. DYNAMIC IMPACTS OF INVESTMENT AND TRADE ON OUTPUT

In order to explain dynamic effects of fixed-capital investment and foreign trade on industrial output, I begin with a set of Granger-causality tests based on the ECM expressed in equation (1). The inclusion of the error term in the autoregressions provides an additional channel through which a potential causal relation between investment (trade) and output can be examined.

Table 4 reports *F*-statistics of the significance tests for the null hypothesis that all lags of investment or trade variable can be excluded from the autoregressions. The computed results show that changes in both fixed-capital investment and merchandise exports had a statistically significant effect on changes in industrial output. In detail, the investment variable was significant in the equations of overall industrial output and sub-grouped outputs at the 0.01 level. The export variable was significant in the equations of overall output, output of the light industrial sector and output of the state enterprises at the 0.05 level, and it was significant in the output equations of the heavy industrial sector and non-state enterprises at the 0.01 level. However, changes in merchandise imports had no statistically significant impact on changes in either overall industrial output or sub-grouped outputs.[10]

Theoretically, changes in industrial output may precede or "cause" changes in fixed-capital investment and trade variables. Beside, changes in imports may indirectly contribute to growth of industrial output through affecting fixed-capital investment and exports. Hence, I conduct causality tests for the following assumptions: (1) industrial output has no causal impact on fixed-capital investment and trade; and (2) imports have no effect on fixed-capital investment and exports. Table 5 reports the estimated results. The autoregressive equations with an error-correction term contain real values for overall industrial output, fixed-

Table 6
Variance Decompositions for Industrial Output Equations
Explained by Investment, Exports and Imports

	own lags	*ΔIM*	*ΔEX*	*ΔFI*
ΔY1:				
6	79.59	2.42	7.07	10.92
12	74.14	4.35	9.59	14.92
24	68.67	5.49	11.22	14.61
36	66.71	5.88	12.35	15.06
∞	65.45	6.36	13.35	14.84
ΔY2:				
6	84.54	3.48	2.94	9.04
12	71.87	5.10	8.70	14.33
24	67.01	5.37	11.95	15.68
36	65.86	5.30	12.89	15.95
∞	66.82	5.52	13.86	13.80
ΔY3:				
6	86.65	1.11	3.09	5.37
12	74.01	4.78	10.21	11.00
24	69.13	4.93	13.83	12.10
36	69.02	4.74	14.41	11.83
∞	70.27	4.46	15.74	5.52
ΔY4:				
6	85.51	1.50	5.92	7.07
12	74.52	3.56	9.04	12.88
24	72.17	4.24	11.46	12.13
36	71.15	4.52	13.04	11.29
∞	70.30	5.51	16.28	7.91
ΔY5:				
6	82.21	2.42	6.52	9.85
12	70.36	7.88	9.96	11.80
24	62.32	12.22	12.45	13.00
36	59.84	12.69	14.28	13.19
∞	59.27	12.79	14.70	13.23

Notes: the orders of orthogonalization for VAR systems are as follows: industrial output, imports, exports and fixed-capital investment. Twelve lags are used for estimating VAR system; seventy-two months forecast-error variance is explained. Also the notes of Table 1.

capital investment, exports and imports, in which investment, exports and imports were alternatively taken as a dependent variable. *F*-statistics shown in the first row did not reject the null hypothesis that output has no effect on investment and trade. Analogously, the results in the second row also failed to reject the null hypothesis that imports do not relate to investment and exports. Hence, the evidence suggests that there exists a unidirectional causal investment-led and export-promoted output growth path, but imports have no indirect contribution to output growth through either investment or exports.

F-tests based on the concept of Granger-causality may suffer an interacting problem because of non-orthogonality of independent variables on the right-hand side of the autoregressions. That is, one explanatory variable may interfere with the possible effect of another explanatory variable on the dependent variable. Sims' method of forecast-error

variance decomposition overcomes this drawback by interpreting orthogonalized residuals in vector autoregressions (VAR). Although this measure may have some bias on the ordering of explanatory variables, it at least provides an alternative approach to explain the predicting power of investment and trade variables for the economic growth.

I use Sims' method of decomposing the forecast-error variances of industrial output equations in a VAR system, which takes the orthogonalization order of industrial output, imports, exports and fixed-capital investment. Twelve lags of each variable are used for estimating the VAR system and seventy-two months forecast-error variances are explained. Table 6 shows the percentage of each variable's movement explained by its own lags, of imports, exports and fixed-capital investment. Although exports and fixed-capital investment were put on the disadvantageous orthogonal ordering, their contributions to 72-month horizon forecast-error variances of each variable were generally one to two times bigger than imports. On the other hand, fixed-capital investment explained higher percentages of variances for overall industrial output and industrial output of the light industrial sector than exports variable, but exports' contributions to the explanations of variances in the rest sub-categories were similar to or a little higher than investment.[11]

Thus, the alternative approach of employing variance decomposition to identify the contributions of investment and trade of industrial output strongly reinforces the results obtained by Granger-causality tests. That is, changes in fixed-capital investment and merchandise exports significantly promoted growth in overall industrial output as well as different sub-categories of industrial output. But changes in merchandise imports had no statistically significant impact on movements of industrial output.

VI. CONCLUDING REMARKS

China has experienced rapid economic growth during the reform period. Meanwhile, fixed-capital investment and foreign trade have phenomenally expanded. This study documents that fixed-capital investment and exports are two important determinants for industrial output growth, while imports are not a significant determinant for output. To a large extent, increases in fixed-capital investment and foreign trade are due to changes in the economic system, especially the progress of economic marketization and decentralization.

Indeed, the empirical evidence suggests that China's economic growth is a pattern based on massive accumulation of physical capital stock that sacrifices current consumption for future production. However, this capital-mobilization growth approach is not sustainable because it will inevitably be faced with two severe limits: (1) diminishing returns to capital input and (2) constraint of available capital sources. To achieve sustained growth, therefore, a comprehensive economic restructuring and relating policies should be undertaken for pursuing productivity-enhanced growth path which focuses on scientific and technological progress.

China's outward-looking development strategy rewards. Export-promoting policies result in a virtuous circle which successfully enhances economic growth. The issue is how to keep the expansive export momentum in the increasingly competitive world market environment through significant improvement in enterprises' productive efficiency and further liberalization of the trade system. In contrast to the positive export-output linkage, however, imports show no observable contribution to economic growth. The prevailing import-license regime and policies may just satisfy certain interest groups, while failing to

promote overall economic performance through channeling high technology and advanced capital formation. This import regime distorts market functioning and raises social costs for the economy. Hence, it is necessary to thoroughly evaluate the import-licensed structure and its relating policies.

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NOTES

1. For example, the shares of state-determined prices for agricultural products, industrial consumer goods and producer goods were respectively reduced from 92 percent, 97 percent and 100 percent in 1978 to 12.5 percent, 5.9 percent and 18.7 percent by the end of 1992 (Tian & Qiao, 1991; Gao, Liu & Zhang, 1994).
2. According to the State Commission of Statistics of China, gross social product (GSP) contains the gross output value in agriculture, industry, construction, commerce, transportation and communication, except services.
3. Non-state owned enterprises include collective owned enterprises, private owned enterprises, joint-venture firms, and others.
4. I use the state fixed-capital investment as a proxy for overall fixed-capital investment, which is not available on the monthly basis.
5. Since the monthly producer price index is not available, I use the retail price index to deflate nominal investment. Analogously, the US GNP deflator is not available on the monthly basis, the US CPI is used to deflate nominal exports and imports measured by the US dollars.
6. The ADF tests were conducted in the same manner proposed by Perron (1989), which searches a particular lagged dependent variable significant at 0.10 level or lower.
7. For brevity, I omit the technical discussion of these approaches.
8. Twelve lags were used in the regression. The lag length is screened by the Schwarz maximum-likelihood criterion. To save space, they are not reported here.
9. See Coe and Moghadam (1993).
10. For the purpose of robustness, I replaced twelve lags with six lags in the tests, the significance levels had no change. I also conducted alternative tests when the nominal terms of fixed investment, exports and imports replaced the real values in the autoregressive equations, but again, the significance levels were not different from the outcomes reported in Table 4.
11. In order to confirm the results obtained from the above variance decomposition, real values of investment and trade variables were replaced by nominal variables in the VAR system. The results indicate that there was no significant difference between the two estimates.

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