Briefing Notes in Economics

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Indexed with the Journal of Economic Literature

Issue No. 68, March/April 2006 http://www.richmond.ac.uk/bne *ISSN 0968-7017*

Asymmetric Regional Effects of Monetary Policy: An Empirical Evaluation of the Japanese Experience*

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Monetary policy suitable for one region may not be suitable for other regions. Using the social loss function, the policy reaction function, and event study approaches, this paper is the first attempt to empirically investigate asymmetric impacts of monetary policy on different regions in Japan. This paper finds that actual monetary policy was more favourable for urban areas than for rural areas and suggests that monetary policy should be supplemented by other policy instruments, such as fiscal expenditures. **JEL: E52, E58**.

Introduction

A central bank uses monetary policy to stabilize the national economy. As the economic structure of each region in a nation varies, regional economies respond differently to changes in monetary policy. Therefore, central banks face a policy dilemma, because its nation-wide policy instruments (e.g., short-term inter-bank interest rates and monetary aggregates) cannot be adopted to suit individual regions. In fact, Carlino and Defina (1998, 1999) found that monetary policy affected real income quite differently in each state in the United States. For

♣ The author thanks an anonymous referee for his valuable suggestions. This research was partially supported by the Ministry of Education, Science, Sports and Culture as part of their Grant-in-Aid for Scientific Research.

example, they found that real income in Michigan fell 2.7 percent and that in New York it fell only 0.7 percent eight quarters after a one-percent-point increase in the federal funds rate.

Little is known about the specific impact of monetary policy on different regions in Japan. In this paper, by using Japanese regional data, we empirically demonstrate the asymmetric effects of monetary policy on all Japanese regions. We make our analyses in three ways: by comparing values from loss functions for different regions; by measuring disparity between the target rates suggested by a specific macroeconomic policy rule and actual call rates; and by describing regional inflation and growth rates before important policy changes.

Data

In the following analysis, the two key variables are real output and inflation rates for the eight regions in Japan: Hokkaido, Touhoku, Kanto, Tokai, Kinki, Chugoku, Shikoku, and Kyushu. The inflation rates used in this paper are based on the general consumer price index (CPI). The data source for the CPI is the *Annual Report on the Consumer Price Index,* published by the Statistics Bureau, Management and Coordination Agency, Japanese Government[1]. As monthly regional GDP data are not available, we used the monthly Indexes of Industrial Production (IIP) regarding Mining and Manufacturing as a proxy for real output. The data source is *The Regional Conditions of Industrial Production in Japan,* published annually by the Ministry of International Trade and Industry.

Our sample consists of the data for the 228 months from January 1980 to December 1998. Table 1 (further below) shows the basic statistics of the CPI inflation rates (π) and the growth rates of IIP (x) for each region as well as the whole nation. Regarding the growth rates, Hokkaido records the lowest mean (0.99%) and Kanto records the highest mean (3.21%). Regarding the CPI inflation rates, Hokkaido records the lowest mean (1.71%), while Kinki records the highest mean (2.05%). Table 1 also displays the correlation between each region and the whole nation regarding the growth rates and the CPI inflation rates. Generally speaking, correlation coefficients regarding the CPI inflation rates are high, while correlation coefficients for the growth rates are relatively low. Particularly, there are apparent differences between three major regions (i.e., Kanto, Kinki and Tokai) and other rural regions in the growth rate's correlation coefficients.

These statistics suggest that regions in Japan are not uniform either in terms of inflation nor production activities. Therefore, monetary policy that is best for, say, Region A can be too expansionary or contractionary for Region B. This theoretical hypothesis is empirically tested in the next section using a variety of techniques as outlined.

[1] CPI was adjusted according to consumption tax reforms in 1989 and 1997.

Methodologies and Analyses

(1) The Loss Function Approach

The following loss function is commonly used in the literature (e.g., Clarida et. al., 1999):

$$\max -\frac{1}{2} E_t \left\{ \sum_{i=0}^{\infty} \beta^i \left[(1-\alpha) x_{t+i}^2 + \alpha \pi_{t+i}^2 \right] \right\}$$

Here, β is a discount factor, x is the output gap, and π is the inflation gap. To avoid infinite loss values, β is assumed to range from zero to one. A small value for β means that the central bank places importance on recent experiences. Finally, α is the relative weight given to inflation. When 'α = 1', the coefficient of the output gap variable is zero, and when 'α = 0', the coefficient of the inflation gap variable is zero. Therefore, 'α = 1' implies that the central bank concerns itself with inflation only and is thus uninterested in unemployment.

The easiest way to discern the regionally specific impacts of monetary policy is to calculate the values of the above loss functions for each region. As the inflation gap and the output gap of each region are not available as data, we used the following method to calculate these gaps in this paper[2]. Namely, we assumed the output gap of Region A at time t to be the difference between actual Region A's growth rate at time t and the sample-period average growth rate for Region A. We call this method "Region-Average Method." We defined the inflation gap in the same manner.

The other methodological problem is that exact values for the weight α and the discount factor β are unknown. However, both a study by Hamori (1992) and our preliminary analysis of actual monthly mean values for call rates during our sample period, suggest a value of β = 0.96. Clarida et. al. (1998) obtained evidence that the Bank of Japan was practically a pure inflation targeter. Their finding suggests α = 1.

Using these parameter values as benchmark, we estimated ex-post cumulative losses for 1980-1998[3]. Based on the Region-Average Method, the benchmark result is shown in the first line of Table 2 (on page 5). Hokkaido suffered the

[2] We also used two other methods to check the robustness of our results. First, we assumed the output gap of Region A at time t to be the difference between Region A's growth rate at time t and the sample-period average growth rate for the whole nation. Using *The Regional Conditions of Industrial Production in Japan,* the sample-period average growth rate for the whole nation was found to be 2.13%. Similarly, we defined the inflation gap as the difference between Region A's inflation rate at time t and the sample-period average inflation rate for the whole nation. The latter value was found to be 1.99%. This method is called "Nation-Average Method" in this paper. This method is assumed that all regions share the same potential economic growth rates and inflation rates. Second, we admitted that the natural growth rate changed over time. We calculated the natural growth rate at time t by using autoregressive models. Due to the data limitation, we assumed the autoregressive process of order three. The inflation gap is derived in the same manner. This method is called "Variable-Average Method" in this paper.

[3] Concretely speaking, we calculate the values of the following equation.

$$\left\{ \sum_{i=1980.01}^{1998.12} \beta^i \left[(1-\alpha) x_i^2 + \alpha \pi_i^2 \right] \right\}$$

largest losses, followed by Chugoku and Touhoku, while major regions (Kanto, Tokai, and Kinki) experienced smaller losses. Table 2 also shows regional losses based on other combination of discount rates and inflation weights. When the weight for the inflation rate is 1.0, Hokkaido is the largest loser, irrespective of the values of discount rates. Irrespective of the choice of discount rate and inflation weight, Kinki, which is the second largest economic region in Japan, is the least loser[4].

In sum, these three methods did not produce exactly the same results and the loser rank depends on the choices made on α and β. However, we find that, irrespective of methods and parameter values, the least loser is one of three urban regions: Kanto (which, incidentally, includes Tokyo), Tokai (including Nagoya), and Kinki (including Osaka). Also, rural regions, such as Hokkaido and Touhoku, tend to suffer larger losses.

[4] As mentioned in footnote 2, we also used the Nation-Average Method and the Variable-Average Method. For the benchmark case (i.e., α = 1 and β = 0.96), Hokkaido is the largest loser and Kinki is the least loser, when we use the Nation-Average Method. The largest loser is Chugoku, and the least loser is Tokai, when we use the Variable-Average Method. Our findings in the text that rural regions suffered more than urban regions are supported by these different methods. The detail results are available from the author upon request.

Table 1: CPI Inflation Rates and Growth Rates by Regions

(January 1980 – December 1998)

	Mean CPI Inflation Rates	Correlation Coefficients of Inflation Rates with the Nation	Mean Growth Rates	Correlation Coefficients of Growth Rates with the Nation	GDP shares (as of FY1994)
Urban Areas					
Kanto	2.042	0.994	3.214	0.852	0.403
Tokai	2.025	0.989	2.232	0.867	0.147
Kinki	2.052	0.986	1.792	0.859	0.164
Rural Areas					
Hokkaido	1.707	0.971	0.994	0.498	0.039
Touhoku	1.97	0.982	3.035	0.801	0.067
Chugoku	1.94	0.982	2.164	0.748	0.058
Shikoku	1.857	0.98	2.248	0.684	0.026
Kyushu	1.918	0.981	2.474	0.744	0.096

Table 2: The Loss Function Approach

	Case1	**Case2**	**Case3**	**Case4**	**Case5**	**Case6**
Discount rate(β)	0.96	0.96	0.95	0.95	0.97	0.97
Inflation weight(α)	1	0.975	1	0.975	1	0.975
Hokkaido	620.8	661.6	545.9	583	708.6	753.3
Touhoku	593.1	675.8	519	594.6	679.9	770.5
Kanto	531.9	636.9	471.4	567.5	602.5	717.5
Tokai	513.1	618.3	450.2	547	586.9	701.4
Kinki	435.5	525.4	383.8	466.2	495.8	594.2
Chugoku	594.2	682.3	518.8	599.8	682.7	778.8
Shikoku	505.1	594.9	442.9	524.1	578.2	677.5
Kyushu	538.9	604.1	471.7	530.7	617.9	690
Nation	499.9	589.6	441	525	568.8	664.7

(2) Policy Reaction Function Approach

Here, we compare target interest rates as per the policy rule suggested by Clarida et. al. (2000) with the actual overnight call rates. First, the simplified policy reaction function for the whole nation was estimated through the two-stage least squares method[5]. The estimated equation is,

$$r_t = \underset{(0.517)}{0.026773} + \underset{(1.748)}{0.045231}\pi_t + \underset{(3.868)}{0.021784}\, x_t + \underset{(55.568)}{0.959287}\, r_{t-1}$$

adj-R^2=0.983

The numbers in the parentheses are t-values.

We used these estimated parameters with the actual values for both the inflation rates and the growth rates of the 8 regions, to calculate the target call rates for 8 regions. Table 3 reflects some of this information. The larger values for Region A mean that the Bank of Japan's (BOJ) policy was less likely consistent with the economic condition of Region A.

We found that differences for Shikoku and Hokkaido were larger than those for Kanto and Kinki, which are the first and second largest economic regions. For example, actual interest rates were almost always higher than Hokkaido's target rates. That is, from the point of view of Hokkaido, the BOJ's monetary policy was in general too tight.

Table 3: Differences between the Target and Actual Interest Rates for Each Region.

	Squared Sum	Simple Mean	Variance
Hokkaido	2279.8	-1.749	6.971
Touhoku	1923.8	-0.365	8.341
Kanto	2021.4	-0.189	8.869
Tokai	2180.4	-0.734	9.064
Kinki	2096.9	-0.939	8.352
Chugoku	2006.6	-0.864	8.09
Shikoku	2396.2	-0.912	9.72
Kyushu	1730.5	-0.722	7.099
Nation	1823.1	-0.831	7.338

(Note) A negative mean value results when actual interest rates are higher than the target rates.

(3) Event Study Type Approach

Decisions regarding introducing changes to the official discount rate are important policy actions. Particularly, the changes from expansionary policy to contractionary policy, and vice versa, have important policy implications. We used the event study approach to investigate whether regional economic conditions were consistent with these drastic policy changes.

During our sample period, there were three important policy changes in discount rates. In August 1980 and July 1991, the Bank of Japan started to decrease the discount rate. Specifically, the official discount rate was decreased from 9% to 8.25% on August 20, 1980, and from

[5] Four lags of call rates, inflation rates and growth rates, as well as a constant term, are used as instrument variables.

6% to 5.50% on July 1, 1991. On May 31, 1989, the BOJ changed its policy stance and raised the discount rate from 2.50% to 3.25%.

Table 4 displays the inflation rates for the average inflation rates for the six month period prior to the policy changes. Although the BOJ started to decrease the discount rate in August 1980, Touhoku, Hokkaido and Chugoku still suffered from relatively higher inflation, while the average inflation rates for Kinki and Kanto were less than 8%. In May 1989, the discount rate was raised in spite of the fact that inflation rates in Hokkaido and Kyushu were very low. BOJ's policy changes were appropriate for economic conditions in major regions (i.e., Kanto, Kinki, and Tokai), but inappropriate for those in some rural regions. In July 1991, Chugoku still suffered higher inflation rates (i.e., 3.9% in June), the BOJ decreased the discount rate.

In sum, BOJ's policy changes were appropriate for economic conditions in major regions, but sometimes inappropriate for those in some rural regions. Furthermore, a similar analysis in terms of the growth rates leads to the same conclusions[6].

[6] The results are available from the author upon request.

Table 4: Average Inflation Rates for Six Month Periods prior to Three Discount Rate Changes

	Decrease in the Discount Rate in August 1980	Increase in the Discount Rate in May 1989	Decrease in the Discount Rate in July 1991
Hokkaido	8.88	0.32	3.35
Touhoku	8.98	0.73	3.6
Kanto	7.97	1.28	3.57
Tokai	8.48	0.97	3.57
Kinki	7.55	1.43	3.55
Chugoku	8.63	0.67	3.65
Shikoku	8.27	0.58	3.28
Kyushu	8	0.47	3.28
Japan	7.87	1.07	3.54

Conclusions

Our study documents the asymmetric regional effects of monetary policy in Japan. Although who is the largest loser or gainer depends on the calculation methods; however, rural areas appear to suffer larger losses. Our paper describes how monetary policy affects individual regions differently, which suggests that other policy instruments that can be adopted for each region may be necessary. For example, because monetary policy is formulated according to the economic conditions in major regions, public expenditures in rural areas might help offset the adverse effects of the general thrust of broader monetary policy objectives introduced with the major regions in mind.

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Book Review

Silvana De Paula and Gary A. Dymski, editors. (2005) Reimagining Growth: Towards a Renewal of Development Theory. Published by Zed Books. PP 308. ISBN 1 84277 585 5.

This edited volume by De Paula and Dymski (respectively: Associate Professor in the Graduate Programme on Development, Agriculture & Society of the Federal Rural University of Rio de Janeiro, and Professor of Economics at the University of California at Riverside) sets itself some ambitious objectives. For example, it is mentioned

early on by the editors that they intend to *explore the role of social and communal relations and institutional structures in determining the pace, depth and persistence of development thinking*. No easy thing given that they, together with 11 other co-opted scholars, attempt their task in the space of just 300 pages.

The book is organized around 4 inter-locking themes. These are noted as 'Framing the Problem', 'Rethinking the Role of Institutions and Macrostructures in Development', 'Rethinking the Microstructure of Development: *Individuals and Communities in Global and Local Spaces*' and 'Rethinking the Participatory Process: *Local and Global Connections*'.

In the first one, *Framing the Problem*, the book confronts the question of what is required to rethink the challenge of development by re-examining the intellectual roots of post-war development theory in Latin America. In this quest the writings of notables such as Raúl Prebisch, on the idea of development through core-periphery inter-dependencies, presented to the first general assemblies of the Economic Commission on Latin America and the Caribbean (ECLAC), is reviewed. Other contributions to this first section investigate the core elements of uneven growth by contrasting neo-classical and other explanations.

The second theme, *Rethinking the Role of Institutions and Macrostructures in Development,* concerns itself with papers that reflect on the nature and consequences of institutional change. The paper by Ha-Joon Chang and Peter Evans on institutional change in its Korean and global contexts is particularly insightful.

Whilst the remaining sections are all highly valuable, it seems to me that the real contributions appear in these first two section as it is here that the real worth of development economics is explored. The remaining sections focus mostly on providing interpretations of some of the specific contributions of a wide group of scholars on issues such as consumption, innovation, the work of the World Social Forum and so on.

Another valuable aspect of the book is in the way in which its authors and editors embrace an altogether interdisciplinary approach. The authors are predominantly academic economists, yet by the standards of today their willingness to write as they do is much more engaging and appealing.

The book will be of value to anyone with an interest in the role of institutions and how they help shape our understanding of development economics in a broad sense.

Parviz Dabir-Alai

Book Note

World Bank (2005) – African Development Indicators 2005. The World Bank: Washington, D.C. PP 406. ISBN 0 8213 6078 7.

By virtue of every conceivable economic measure Africa is, and has been for a long time, the world's poorest and economically marginalised continent. Both distant and recent historical contexts for this are too complex for exploration here. But any such investigation would require detailed information on the key macroeconomic variables as well as data on trade flows, aid, government finances, economic structures, environmental records and health. The strength of this publication is that it provides the basis for researchers to carry out their explorations into the

record of African economic achievements and failures by enabling access to data on the above measures and a whole host of other material. In all around 1200 indicators have been reported covering 53 countries.

The many tables and matrices found with this volume are fully supported by sets of *Technical notes* appearing at the end of every chapter. These notes spell out the relevant assumptions, methodology and any of the important limitations.

The current volume is the 10th in an almost continuous (gap in 1993 and some shared years) series published by the World Bank. One of the key strengths of the book is its attempt to both standardise and harmonise related data sets that would have been sourced from a variety of agencies. However, it has to be said, that despite the Bank's best efforts, full comparability can not be ensured as invariably there will be differences in statistical methods, coverage and definitions used by the original source documents. Still, African Development Indicators 2005 is a valuable contribution for just about every Africa watcher.

Parviz Dabir-Alai

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