行政院國家科學委員會專題研究計畫 成果報告

貨幣、匯率與動態均衡之學術前沿研究--子計畫七：匯率預測：估計風險之角色(4/4)
研究成果報告(完整版)

計 畫 類 別 ： 整合型
計 畫 編 號 ： NSC 98-2752-H-004-001-PAE
執 行 期 間 ： 98 年 04 月 01 日至 99 年 12 月 31 日
執 行 單 位 ： 國立政治大學國際貿易學系

計 畫 主 持 人 ： 郭炳伸

報 告 附 件 ： 國外研究心得報告
出席國際會議研究心得報告及發表論文

公 開 資 訊 ： 本計畫涉及專利或其他智慧財產權，2 年後可公開查詢

中 華 民 國 101 年 05 月 03 日

中 文 摘 要 ：

中文關鍵詞：

英 文 摘 要 ： This paper develops a simple long-difference transformation for estimation and inference in general AR(1) models. As in Phillips and Han (2008), a Gaussian limit theory with a convergence rate of $\sqrt{T}$ is available, whether or not a unit root is present in the process. Yet, the novelties of our limit results are that the same weak convergence applies to the models with or without trend, and that the asymptotic distribution is characterized by a constant variance of value 2. The merits promise usefulness of the long-difference transformation in applications to dynamic panels.

英文關鍵詞： unit root, AR model, long difference, first difference

I. COVER

Program for Promoting Academic Excellence of Universities（Phase II）

Midterm Report

匯率預測：估計風險之角色 (4/4)

Understanding Exchange Rate Predictability: The Role of Estimation Risk (4/4)

Serial No.: 98-2752-H-004-001-PAE

Overall Duration: Month 04 Year 06 - Month 03 Year 10
Report Duration: Month 04 Year 09 - Month 03 Year 10

National Chengchi University
01/10/10

II. (FORM1) BASIC INFORMATION OF THE PROGRAM/Sub-project

Program/Sub-project Title: 匯率預測：估計風險之角色(4/4) Understanding Exchange Rate Predictability: The Role of Estimation Risk (4/4)					
Serial No.: 98-2752-H-004-001-PAE			Affiliation		
Principal Investigator	Name	郭炳伸 Biing-Shen Kuo	Program Coordinator	Name	
	Tel:	(02) 29393091 ext 81029		Tel:	
	Fax:	(02) 29387699		Fax:	
	E-mail	bsku@nccu.edu.tw		E-mail	

	Expenditures[1] (in NT$1,000)		Manpower[2]:Full time/Part time(Person-Months)	
	Projected	Actual	Projected	Actual
FY 95	1052	1052	3	3
FY 96	1052	1052	3	3
FY 97	1052	1052	3	3
FY98	1052	483	3	3
Overall	4208	3639	12	12

Serial No.	Project Title	Principal Investigator	Title	Affiliation
Serial No. (95)	95-2752-H-004 -002 -PAE	郭炳伸 Biing-Shen Kuo	教授 Professor	政治大學國貿系 National Chengchi Univ.
Serial No. (96)	96-2752-H-004-002-PAE	郭炳伸 Biing-Shen Kuo	教授 Professor	政治大學國貿系 National Chengchi Univ.
Serial No. (97)	97-2752-H-004-002-PAE	郭炳伸 Biing-Shen Kuo	教授 Professor	政治大學國貿系 National Chengchi Univ.
Serial No. (98)	98-2752-H-004-001-PAE	郭炳伸 Biing-Shen Kuo	教授 Professor	政治大學國貿系 National Chengchi Univ.

Notes: [1,2] Please explain large differences between projected and actual figures.

Program Director/Principle Investigator Signature: 郭炳伸

III. (FORM 2) LIST OF WORKS, EXPENDITURES, MANPOWER, AND MATCHING SUPPORTS FROM THE PARTICIPATING INSTITUTES（REALITY）.

Serial No.: (95)		Program/Sub-project Title: (95)										
Research Item (Include sub projects)	Major tasks and objectives	Expenditures (in NT$1,000)					Manpower (person-month)					Matching Supports from the Participating Institutes (in English & Chinese)
		Salary	Seminar/ Conference-related expenses	Project- related expenses	Cost for Hardware & Software	Total	Principal Investigators	Consultants	Research/ Teaching Personnel	Supporting Staff	Total	
Sub-project 10	Develop of new estimators and explore its application	660	186	63	36	945	1	0	2	0	3	0
SUM		660	186	63	36	945	1	0	2	0	3	0

Serial No.: (96)		Program/Sub-project Title: (96)										
Research Item (Include sub projects)	Major tasks and objectives	Expenditures (in NT$1,000)					Manpower (person-month)					Matching Supports from the Participating Institutes (in English & Chinese)
		Salary	Seminar/ Conference-related expenses	Project- related expenses	Cost for Hardware & Software	Total	Principal Investigators	Consultants	Research/ Teaching Personnel	Supporting Staff	Total	
Sub-project 10	Develop of new estimators and explore its applications	680	140	85	30	935	1	0	2	0	3	0
SUM		680	140	85	30	935	1	0	2	0	3	0

Serial No.: (97)		Program/Sub-project Title: (97)										
Research Item (Include sub projects)	Major tasks and objectives	Expenditures (in NT$1,000)					Manpower (person-month)					Matching Supports from the Participating Institutes (in English & Chinese)
		Salary	Seminar/ Conference-related expenses	Project- related expenses	Cost for Hardware & Software	Total	Principal Investigators	Consultants	Research/ Teaching Personnel	Supporting Staff	Total	
Sub-project 10	Develop of new estimators and explore its application	700	207	21	18	946	1	0	2	0	3	0
SUM		700	207	21	18		1	0	2	0	3	0

Serial No.: (98)		Program/Sub-project Title: (98)										
Research Item (Include sub projects)	Major tasks and objectives	Expenditures (in NT$1,000)					Manpower (person-month)					Matching Supports from the Participating Institutes (in English & Chinese)
		Salary	Seminar/ Conference-related expenses	Project- related expenses	Cost for Hardware & Software	Total	Principal Investigators	Consultants	Research/ Teaching Personnel	Supporting Staff	Total	
Sub-project 10	Develop of new estimators and explore its application	432	96	41	0	569	1	0	2	0	3	0
SUM		432	96	41	0	569	1	0	2	0	3	0

IV. (FORM 3) STATISTICS ON RESEARCH OUTCOME OF THIS PROGRAM/Sub-project

(95)

LISTING		TOTAL	DOMESTIC	INTERNATIONAL	SIGNIFICANT[1]	CITATIONS[2]	TECHNOLOGY TRANSFER
PUBLISHED ARTICLES	JOURNALS						
	CONFERENCES			1			
	TECHNOLOGY REPORTS						
PATENTS	PENDING				-		
	GRANTED				-		
COPYRIGHTED INVENTIONS	ITEM						
WORKSHOPS/CONFERENCES[3]	ITEM		1				
	PARTICIPANTS		Around 20				
TRAINING COURSES (WORKSHOPS/CONFERENCES)	HOURS						
	PARTICIPANTS						
PERSONAL ACHIEVEMENTS	HONORS/ AWARDS[4]						
	KEYNOTES GIVEN BY PIS						
	EDITOR FOR JOURNALS						
TECHNOLOGY TRANSFERS	ITEM						
	LICENSING FEE						
	ROYALTY						
INDUSTRY STANDARDS[5]	ITEM						
TECHNOLOGICAL SERVICES[6]	ITEM				-	-	-
	SERVICE FEE				-	-	-

[1] Indicate the number of items that are significant. The criterion for "significant" is defined by the PIs of the program. For example, it may refer to Top journals (i.e., those with impact factors in the upper 15%) in the area of research, or conferences that are very selective in accepting submitted papers (i.e., at an acceptance rate no greater than 30%). Please specify the criteria in Appendix IV.

[2] Indicate the number of citations. The criterion for "citations" refers to citations by other research teams, i.e., exclude self-citations.

[3] Refers to the workshop and conferences hosted by the program.

[4] Includes Laureate of Nobel Prize, Member of Academia Sinica or equivalent, fellow of major international academic societies, etc.

[5] Refers to industry standards approved by national or international standardization parties that are proposed by PIs of the program.

[6] Refers to research outcomes used to provide technological services, including research and educational programs, to other ministries of the government or professional societies.

(96)

(96)

Listing		Total	Domestic	International	Significant[1]	Citations[2]	Technology Transfer
Published Articles	Journals						
	Conferences						
	Technology Reports						
Patents	Pending				-		
	Granted				-		
Copyrighted Inventions	Item						
Workshops/Conferences[3]	Item	3	1	2			
	Participants	Around 60	Around 20	Around 40			
Training Courses (Workshops/Conferences)	Hours						
	Participants						
Personal Achievements	Honors/ Awards[4]						
	Keynotes Given by PIs						
	Editor for Journals						
Technology Transfers	Item						
	Licensing Fee						
	Royalty						
Industry Standards[5]	Item						
Technological Services[6]	Item				-	-	-
	Service Fee				-	-	-

[1] Indicate the number of items that are significant. The criterion for "significant" is defined by the PIs of the program. For example, it may refer to Top journals (i.e., those with impact factors in the upper 15%) in the area of research, or conferences that are very selective in accepting submitted papers (i.e., at an acceptance rate no greater than 30%). Please specify the criteria in Appendix IV.
[2] Indicate the number of citations. The criterion for "citations" refers to citations by other research teams, i.e., exclude self-citations.
[3] Refers to the workshop and conferences hosted by the program.
[4] Includes Laureate of Nobel Prize, Member of Academia Sinica or equivalent, fellow of major international academic societies, etc.
[5] Refers to industry standards approved by national or international standardization parties that are proposed by PIs of the program.
[6] Refers to research outcomes used to provide technological services, including research and educational programs, to other ministries of the government or professional societies.

(97)

Listing		Total	Domestic	International	Significant[1]	Citations[2]	Technology Transfer
Published Articles	Journals						
	Conferences						
	Technology Reports						
Patents	Pending				-		
	Granted				-		
Copyrighted Inventions	Item						
Workshops/Conferences[3]	Item	3	1	2			
	Participants	Around 80	Around 40	Around 40			
Training Courses (Workshops/Conferences)	Hours						
	Participants						
Personal Achievements	Honors/ Awards[4]						
	Keynotes Given by PIs						
	Editor for Journals						
Technology Transfers	Item						
	Licensing Fee						
	Royalty						
Industry Standards[5]	Item						
Technological Services[6]	Item				-	-	-
	Service Fee				-	-	-

[1] Indicate the number of items that are significant. The criterion for "significant" is defined by the PIs of the program. For example, it may refer to Top journals (i.e., those with impact factors in the upper 15%) in the area of research, or conferences that are very selective in accepting submitted papers (i.e., at an acceptance rate no greater than 30%). Please specify the criteria in Appendix IV.
[2] Indicate the number of citations. The criterion for "citations" refers to citations by other research teams, i.e., exclude self-citations.
[3] Refers to the workshop and conferences hosted by the program.
[4] Includes Laureate of Nobel Prize, Member of Academia Sinica or equivalent, fellow of major international academic societies, etc.
[5] Refers to industry standards approved by national or international standardization parties that are proposed by PIs of the program.
[6] Refers to research outcomes used to provide technological services, including research and educational programs, to other ministries of the government or professional societies.

(98)

Listing		Total	Domestic	International	Significant[1]	Citations[2]	Technology Transfer
Published Articles	Journals						
	Conferences						
	Technology Reports						
Patents	Pending				-		
	Granted				-		
Copyrighted Inventions	Item						
Workshops/Conferences[3]	Item	1	1				
	Participants	80	80				
Training Courses (Workshops/Conferences)	Hours						
	Participants						
Personal Achievements	Honors/ Awards[4]						
	Keynotes Given by PIs						
	Editor for Journals						
Technology Transfers	Item						
	Licensing Fee						
	Royalty						
Industry Standards[5]	Item						
Technological Services[6]	Item				-	-	-
	Service Fee				-	-	-

[1] Indicate the number of items that are significant. The criterion for "significant" is defined by the PIs of the program. For example, it may refer to Top journals (i.e., those with impact factors in the upper 15%) in the area of research, or conferences that are very selective in accepting submitted papers (i.e., at an acceptance rate no greater than 30%). Please specify the criteria in Appendix IV.
[2] Indicate the number of citations. The criterion for "citations" refers to citations by other research teams, i.e., exclude self-citations.
[3] Refers to the workshop and conferences hosted by the program.
[4] Includes Laureate of Nobel Prize, Member of Academia Sinica or equivalent, fellow of major international academic societies, etc.
[5] Refers to industry standards approved by national or international standardization parties that are proposed by PIs of the program.
[6] Refers to research outcomes used to provide technological services, including research and educational programs, to other ministries of the government or professional societies.

V. (FORM4) EXECUTIVE SUMMARY ON RESEARCH OUTCOMES OF THIS PROGRAM/Sub-project

(Please state the followings concisely and clearly)

1. General Description of the Program/Sub-project: Including Objectives of the Program

The research attempts to offer econometric explanations to the near random-walk exchange rates. It argues that previous empirical evidence for or against predictability in exchange rate movements might have been considerably flawed by the existence of estimation risk due to the strong persistence in fundamentals. The primary goal of the project is in a pursuit of a more reliable inference procedure for the predictability both in-sample and out-of-sample by appropriately controlling the estimation risk.

To achieve the goal, an averaging estimator that combines information optimally both from the univariate time series under study and from cross-sectional time series is developed.

Another goal of the project is to explore useful applications of the idea of the averaging estimator. While the project starts with an attempt to establish robust inference procedures for the exchange rate predictability using the averaging estimator, the estimator itself, through combination, offers alernative ways to make better use of the information from the data. This is important because efficiency or power gains could be anticipated when the information from the data is better exploited.

2. Breakthroughs and Major Achievements

Evidence for the exchange rate predictability in the past literature has been mixed. In contrast, the current project, after controlling the estimation risks, is able to establish a more uniform evidence for the predictability, whether the forecasting horizons are short or long. This is somehow remarkable because to our knowledge, little evidence for the exchange rate predictability in the short horizons was found in the literature.

In addition to establishing evidence for the predictability, two major conclusions emerging from the research so far can be summarized: 1) the magnitude of the estimation risks is so high that the exchange rate predictability can be masked even when it exists in the data; 2) The information about exchange rate movements from cross-section is valuable in the ways that it can reduce the estimation risk and thus improve the testing power for predictability, if it could be exploited effectively as the averaging estimator does.

To extend the idea of the averaging estimator further, we also developed a new difference-based estimator. Of significance is that a Gaussian limit is found to be available for the estimator, whether a unit root presents in the data generated from simple autoregressions.

3. Categorized Summary of Research Outcomes. The criteria for top conferences and journals should be given and introduced briefly in the beginning of this section. In each research area, please give a brief summary on the research outcomes associated with the area. Note that the summaries should be consistent with the statistics given in Form3. Please list and number each research outcomes in sorted order in Appendix II, and list all the publications in top conferences and journals in Appendix III.

3.1 Development of an avaraging estimator (1/4):

An averaging estimator that is to control potential estimation risks associated with the predictive regression is developed in the first-year study. The sources of the estimation risks comes from high persistence of predictive regressors, and the dependent variable being the overlapping sums of short-horizon change in log exchange rate. The former creates bias in small-samples and the latter brings forth remarkable estimation variability in long-horizon predictions.

The considered averaging estimator optimally combines two alternative estimators that differ in their bias and

precision characteristics. By construction, the suggested estimator for the slope coefficients utilizes information from cross-sections in a similar way that the panel-based estimators do. The implicit assumption underlying the use of information from cross-sections for our estimator, however, is very much different from that for the panel-based estimators. In contrast, the panel-based estimators are built on the assumption that the slope coefficients are all the same for all the cross-sectional countries. On the other hand, the averaging estimator allows for separate slope estimate for each cross-section country as the OLS estimator does, but makes use of the cross-sectional information that the OLS estimator does not. Thus both the averaging estimator and the pooled estimator are the same to reduce the estimation errors, but differ in the way how the cross-sectional information is processed. Yet, our averaging estimator has the advantages of producing more reasonable slope estimates.

3.2 Risk reduction: simulation analysis (1/4)

We examined to what extent the proposed estimator can improve over the traditional estimator in terms of risk reduction through simulations. Under the setup that mimics the reality, we documented that the averaging estimator empirically dominates the least-square (LS) estimator, regardless of which simulation scenario is considered. Virtually the risk reductions using the averaging estimator can be as large as between 10\% and 35\%, compared with the LS estimator. More importantly, the risk improvement by the averaging estimator is embodied further into power gains in testing. Our simulation shows that the power gains from using the averaging estimator, again relative to the LS estimator, is 10% to 30% or more in many cases. An significant implication of the finding is simply that the predictability alternative can now be better detected from the data when the test statistics are based on the averaging estimator.

3.3 A re-examination of the exchange rate predictability (2/4)

We re-investigated the empirical validity of the exchange rate predictability applying the averaging estimator. The testing strategy basically follows that utilized in the literature where these studies all base their inference on the bootstrap approach in order to control for small-sample bias for which the asymptotic approximation generally fails to correct.

We accessed the relative forecast accuracy of the two competing models with Theil's U and DM statistics. It should be noted that the problem with estimating the long-run variance precisely when calculating the DM statistic often leads to spurious inference. Important messages emerging from the empirical exercises include:

1) There is now much more significant evidence presented for the dominance of the monetary model over the random walk when predicting, after accounting for estimation risks using the considered estimator. With only few exceptions, the p-values associated with the averaging estimator for both statistics are smaller, relative to those associated with the LS estimator.

2) It stands out from the results that controlling over the risks uncovers more favorable evidence in supports of the monetary model, while there is essentially no evidence for so when leaving the risks unattended. Many more instances of this are found from the reported Theil's U statistic. Particularly, at almost all horizons, the monetary model is found to be superior to the random walk in terms of predictability for Germany and Japan. This contrasts sharply with the previous findings where little evidence for predictability is reported. Considering the Theil's U statistic is more robust, this evidence lends quite a good deal of credence to the predictability at both short- and long-horizons.

3.4 Asymptotic theory of the averaging estimator (3/4)

The use of the averaging estimator in testing for exchange rate predictability brings forth some econometric interesting questions. This entails the development of an asymptotic theory of the averaging estimator. We invoke a local-to-unity framework to build the asymptotic theory based on the observation with inherent high persistence in the data. We are now able to derive the asymptotic distributions of the averaging estimator under the simplified assumptions where regression errors are uncorrelated with predicting variables. The asymptotic distribution derived is a mixture normal. The mixture normal collapses into the limit distribution of the

least-square estimator, or that of the panel estimator, when either receives zero weights in forming the averaging estimator.

3.5 Development of a new differenced-base estimator (4/4)

Our difference-based estimator possesses a number of interesting properties. Firstly, the transformed second-difference estimator of the autoregressive coefficient has a Gaussian asymptotic distribution that applies to both the unit root case and conventional cases. This implies that the normality limit stands for the local-to-unity cases as well. Thus, the limit distribution is continuous as the autoregressive coefficient passes through unity. Our simulations further reveals that the estimator displays negligible bias for very small samples, as opposed to the conventional least squares estimator. Moreover, the limit distribution of our estimator in simple AR(1) models without time trend exhibits a constant variance of value 2. This is in contrast to the competing estimator, which is a linear increasing function of the autoregressive coefficient. Particularly, the limit variance for our estimator is smaller for that of the competing counterpart for any positive autoregressive coefficients. When a time trend in the model is entertained, the corresponding limit variance of our estimator is much less affected by the underlying true coefficients than that of the competing and Han estimator. The estimation efficiency may turn into power gains for tests built on the estimator in dynamic panel contexts.

4. International Cooperation Activities (Optional)

VI. Appendix I: Minutes from Program Discussion Meetings

VII. Appendix II:

1. Publication List（Conferences, Journals, Books, Book Chapters, etc.）
2. Patent List
3. Invention List
4. List of Workshops/Conferences Hosted by the Program
5. List of Personal Achievements of the PIs
6. List of Technology Transfers
7. List of Technology Services

Publication List

Working paper:

first year and second year:

Doing Justice to Fundamentals in Exchange Rate Forecasting: A Control over Estimation Risks (under review)

third year:

Averaging to Improve Efficiency in Time Series Regressions

fourth year:

Gaussian Inference in General AR(1) Models Based on Long Difference

VIII. Appendix III: List of Publications in "Top" Journals and Conferences

Publications:

first year:

N/A

second year:

N/A

third year:

N/A

fourth year

N/A

IX. Appendix IV: Slides on Science and Technology Breakthroughs

(TWO SLIDES FOR EACH BREAKTHROUGH)

X. APPENDIX V: MIDTERM/FINAL SELF-ASSESSMENT

PROGRAM TITLE: Gaussian Inference in General AR(1) Models Based on Long Difference

	ASSESSMENT SUBJECT	SCORE (1~5, LOW TO HIGH)
PROGRAM'S CONTENTS & PERFORMANCE	Importance & Innovation of the Program's Major Tasks	4
	Clarity and Presentation of the Report	4
	Viability of the Program's Approaches & Methodologies	4
	Principal Investigator's Competence for Leading the Program	3
	Interface & Integration between Overall & Sub-Project(s)	3
	Interface & Integration among All Sub-Projects	2
	Manpower & Expenditures	4
PROGRAM'S RESULTS	Contribution in Enhancing the Institute's International Academic Standing	4
	Impact on Advancing Teaching or on Technology Development	2
Total Score		30

REVIEWER'S COMMENTS & SUGGESTION:

1. **This question is important, because it is closely related to the unit root testing and can be generalized to the panel unit root literature.**

2. **The authors then focus on the case $k = 2$, i.e., the second-order difference operator.**

3. **The authors propose a second-order difference operator, $(1 - L^2)$, as compared to the usual first-order difference operator, $(1 - L)$, used in Phillips and Han (2008).**

4. **The second-order differencing estimator is asymptotically normal under suitable regularity conditions. The asymptotic variance of the second-order differencing estimator does not depend on the value of ρ. Furthermore, the proposed estimator is more efficient than the first-order differencing estimator of Phillips and Han (2008) when $\rho > 0$. This result is interesting because most macroeconomic time series belong to this category.**

5. **P. 2, line 12?, why $\Delta^2 y_{t-1} = O_p(\rho^t)$ when $\rho > 1$? Any proof or reference?**

6. **Section 3 considers the case where there is a linear trend in the data-generating process (DGP). Phillips and Han (2008) propose a double FD operator to deal with this case. The double FD estimator for the model in (1) is shown to be asymptotic normal. One interesting question is that the FD estimator of Phillips and Han (2008) can be modified to deal with the model with a linear trend without using the double FD estimator.**

7. **The authors might consider the relative efficiency of the double FD estimator with the modified single FD estimator under the model in (1) when $\rho \leq 1$. This might provide an alternative estimator for the dynamic panel data model.**

8. **The same argument also applied to the single second-order differencing estimator and the double second-order differencing estimator under the same set-up.**

9. **What is the order of magnitude of $\Delta^{1,1} y_{t-1}$ when $\rho > 1$? What is the order of magnitude of $\Delta^{2,2} y_{t-1}$ when $\rho > 1$? This is related to the local behavior of the estimator around $\rho = 1$.**

10. **What would happen if there are lagged dependent variables $y_{t-2}, \ldots, y_{t-k}$ at the RHS?**

PRINCIPLE INVESTIGATOR'S FEEDBACK: (AVAILABLE)

1. **Comments 1-4 are summaries of the paper.**
2. **Comment 5: Take the long difference on AR(1), and recursively substituting the lag dependent variables backwards, the desired result will be established.**
3. **Comment 6: The asymptotics for the double FD estimator indeed are very much involved for the models with time trend. After the conference, we thought hard about the comment by the referee, and did find another much simpler transformation that can yield the normality as the double FD estimator does. We shall report the results in the revision of the paper.**
4. **Comment 7: We will investigate the possibility.**
5. **Comment 8: A suggestion that will be well-taken.**
6. **Comment 9: 2 cases need to be considered when $\rho > 1$, the explosive AR(1) system and the midly explosive AR(1) system. The paper does not investiage the former case as its asymptotics is non-standard again. But the considered system falls into the latter case, the normality results applies as we found for the simple models without trend in the paper.**
7. **Comment 10: This is a hard question. We have tried to consider AR(2) models. But it turned out that the calculations were very much involved and the derivations did not lead to results of significance.**

Program Reviewer's Signature: 蔡文禎 Tsai, Wen-Jen

Sub-project #7 Understanding Exchange Rate Predictability: The Role of Estimation Risk 4/4

1 Introduction and Summary

Difference-type transformation has been one of commonly employed practices in time series related research. In studies with dynamic panel data, differencing eliminates the need to estimate fixed-effect parameters. In cases where the data is generated by a unit root series, by doing so, the stationarity of the series under transformation can be achieved. The transformations, such as Prais-Winsten estimator and Cochrane-Orcutt estimator, are also useful in reducing the degrees of autocorrelations in regression errors. Efficiency of the resulting estimates can be made close to the bound attained by the Gauss-Markov theorem. Research in the previous years of the project suggests that a combination between the difference estimator and the OLS one leads to efficiency improvements in time series contexts. Furthermore, Phillips and Han (2008) as well as Paparoditis and Politis (2000) show that the difference-based method leads to the standard Gaussian asymptotic theory for the AR(1) series, irrespective of whether the series is a unit root process.

The clever transformation of Phillips and Han (2008) and Paparoditis and Politis (2000) comes from the observation that the autoregressive coefficient of concern is in a one-to-one linear relation to the first-order autocorrelation coefficient for the differenced series. Rather than on the level regressions, the autoregressive coefficient can now be recovered by working on the transformed differenced regressions. Because of the stationarity nature of the differenced series, the unusual limit normality is able to be obtained for all values of the autoregressive coefficient, including the case of a unit root. It thus avoids the discontinuity problem in the limit distributions associated with the level regressions (Phillips and Han, 2008).

This paper investigates whether the aforementioned transformation is unique to the considered AR(1) models. Of particular concern is if any linear relations that could yield standard limit results remain to be found, when "higher-order difference" technique applies. Our inquiry into the question arises from the potential uses of the difference-based estimator. Virtually, regardless of which order is taken on AR(1) process, to obtain consistency for the parameter entails the estimation of the method of moments. While the method of mo-

ments estimator is useful to achieve the consistency in large samples, it is found to suffer small-sample bias, specifically in the context with panel data. Hahn et al. (2007) advocate the long-difference method of Griliches and Hausman (1986), an extreme version of higher-order difference, to reduce the small-sample problem in this situation. Nevertheless, Han and Phillips (2009) show that their difference-based estimator, when applying to dynamic panel data models, basically incur no bias, even in the cases where time dimension of the data is very short. More than this, their estimator is immune to the weak instrument problem that occurs to some of the widely used method of moments estimator for the cases where the autoregressive coefficient is close of unity. The Phillips and Han estimator is actually based on the notion of processing the first-difference time series under study. Seeing these practical advantages, whether the notion with processing data is applicable to higher-order difference time series equally deserves careful investigations.

We demonstrate in this part of the sub-project that for second-difference AR(1) series, another transformation which gives rise to some linear relationship between the AR coefficient and the autocorrelation coefficient does exist. The transformation is distinct from that for first-difference series uncovered by Phillips and Han (2008) and Paparoditis and Politis (2000). There, however, is essentially no such linear transformations available for any higher-order-difference series.

Our difference-based estimator possesses a number of interesting properties. Like that of Phillips and Han (2008), the transformed second-difference estimator of the autoregressive coefficient has a Gaussian asymptotic distribution that applies to both the unit root case and conventional cases. This implies that the normality limit stands for the local-to-unity cases as well. Thus, the limit distribution is continuous as the autoregressive coefficient passes through unity. Our simulations further reveals that the estimator displays negligible bias for very small samples, as opposed to the conventional least squares estimator. Chen and Kuo (2009) in fact show analytically that the finite-sample bias for both Phillips and Han estimator and ours shares the same approximate magnitudes. Moreover, the limit distribution of our estimator in simple AR(1) models without time trend exhibits a constant variance of value 2. This is in contrast to that of Phillips and Han estimator, a linear increasing function of the autoregressive coefficient. Particularly, the limit variance for our estimator is smaller for that of Phillips and Han estimator for any positive autoregressive coefficients, typical situations encountered in practice. When a time trend in the model is entertained, the corresponding

limit variance of our estimator is much less affected by the underlying true coefficients than that of Phillips and Han estimator. The estimation efficiency may turn into power gains for tests built on the estimator in dynamic panel contexts.

2 Model and the Transformation

Consider a simple autoregressive model where $y_t = \alpha + u_t,\ u_t = \rho u_{t-1} + \varepsilon_t$, where ρ is the autoregressive coefficient of interest, $\varepsilon_t \sim iid(0, \sigma^2)$, and $\rho \in (-1, 1]$. The structural AR(1) model above corresponds to a reduced form written as

$$y_t = (1-\rho)\alpha + \rho y_{t-1} + \varepsilon_t \tag{1}$$

from which the data generated is a simple unit root process for the boundary case, or a stationarity process when $|\rho| < 1$. Now consider a long-difference-type transformation of (1):

$$\triangle^k y_t = \rho \triangle^k y_{t-1} + \triangle^k \varepsilon_t, \tag{2}$$

where $\triangle^k = (1 - \mathcal{L}^k) = (1-\mathcal{L})(1 + \mathcal{L} + \mathcal{L}^2 + \cdots + \mathcal{L}^{k-1})$, with $\mathcal{L}$ being the lag operator. Note that the orthogonality condition for the transformed model does not generally hold, as $\mathrm{E}[\triangle^k y_{t-1} \triangle^k \varepsilon_t] = \mathrm{E}[\triangle^k y_{t-1}(\triangle^k y_t - \rho \triangle^k y_{t-1})] = -\rho^{k-1}\sigma^2$. As a result, inconsistent estimates of the coefficient are well expected when the least squares principle applies to (2). Phillips and Han (2008) derived a simple transformation of the first differenced equation that can yield consistent estimates using least squares. We intend to investigate if any transformations of the kind of Phillips and Han (2008) exist for the long-differenced equations. As in Phillips and Han (2008), the transformed regression takes the form:

$$\triangle^k y_t = (\rho - \phi)\triangle^k y_{t-1} + (\triangle^k \varepsilon_t + \phi \triangle^k y_{t-1}) = \theta \triangle^k y_{t-1} + \eta_t. \tag{3}$$

where $\theta = \rho - \phi$, $\eta_t = \triangle^k \varepsilon_t + \phi \triangle^k y_{t-1}$, and ϕ is the coefficient to be determined from the transformation. The desired transformation is to re-establish the orthogonality condition. Thus, we expect the following condition $\mathrm{E}(\triangle^k y_{t-1}\eta_t) = \mathrm{E}[\triangle^k y_{t-1}(\triangle^k \varepsilon_t + \phi \triangle^k y_{t-1})] = 0$ to hold for the transformed regression. We can thus solve for $\phi = \frac{\rho^{k-1}(1-\rho^2)}{2(1-\rho^k)}$, which only is a function of the autoregressive coefficient, given any k. Taking advantage of the derived equivalence relations above, the estimated autoregressive coefficient can now be recovered from the relation that $\theta = \rho - \frac{\rho^{k-1}(1-\rho^2)}{2(1-\rho^k)}$.

Inversion of the autoregressive coefficient from the derived relation requires solving non-linear equations. Exceptions are the cases for $k = 1$ and 2. When $k = 1$, $\theta = \frac{1}{2}(\rho - 1)$ which leads to the simple transformation of Phillips and Han (2008), and the transformed regression $2\triangle y_t + \triangle y_{t-1} = \rho\triangle y_{t-1} + 2\eta_t$. Furthermore, when $k = 2$, an alternative linear relation indeed exists between θ and ρ where $\theta = \frac{\rho}{2}$.

This gives a new long-difference regression:

$$2\triangle^2 y_t = \rho\triangle^2 y_{t-1} + 2\eta_t, \text{ or } \quad 2\triangle^2 y_t = \rho\triangle^2 y_{t-1} + \zeta_t, \tag{4}$$

where $\zeta_t = 2\eta_t = 2\triangle^2 y_t - \rho\triangle^2 y_{t-1}$. The regression can be exploited to produce consistent estimates of the autoregressive coefficient.

3 Main Result

The least-squares estimator of the coefficient based on the new long-difference regression (4) is found as $\hat{\rho}_{\text{MLD}} = 2\frac{\sum_{t=1}^{T} \triangle^2 y_{t-1}\triangle^2 y_t}{\sum_{t=1}^{T} \triangle^2 y_{t-1}^2}$.

We are now in a position to demonstrate the main result of the paper concerning the transformed long-difference estimator:

Theorem 1. *If* $\rho \in (-1, 1\,]$, $\sqrt{T}(\hat{\rho}_{\text{MLD}} - \rho) \Rightarrow N(0, 2)$, *as* $T \to \infty$.

Like the Phillips and Han estimator, a Gaussian limit theory applies to the long difference estimator, regardless of whether or not a unit root presents in the process. The limit result is also featured by a constant asymptotic variance for the long difference estimator, as opposed to $2(1 + \rho)$ for the Phillips and Han counterpart. The estimators have the same variance when $\rho = 0$. But for the cases with positive autoregressive coefficients, typically seen in applications, the long difference estimator exhibits an increasingly smaller variance than the Phillips and Han estimator does, as ρ increases to 1. Asymptotic testing procedures based on the result do not reply on the asymptotic variance estimates, thereby being less subject to estimation errors. It proves to be an advantage if the limit approximation in the finite samples is accurate.

行政院國家科學委員會補助國內專家學者赴國外短期研究報告

99 年 11 月 16 日

姓名	郭炳伸	服務機構及職稱	國立政治大學國貿系教授
時間 地點	2010/10/31-2010/11/06 Dept Economics, U. Wisconsin, Medison	本會核定補助文號	NSC 98-2752-H-004-001-PAE

一、短期研究經過

威斯康辛大學麥迪遜分校的經濟系係全美經濟排名年年 10 名內的名校。該系以個體應用與理論以及計量理論著稱。但最近該系又網羅國際金融研究成果斐然的學者，更是如虎添翼。該系也聘有過去我博士論文的指導教授，Prof. Hansen。在這個時候，訪問該系意義非凡。

二、心得

這次訪問主要目的在於，完成手頭匯率預測性研究一文。該文主要是利用組合估計式，探討匯率的預測性。匯率預測實為國際金融重要實證課題，但文獻的結論卻莫衷一是。這當中最重要的原因為，若基本面變數真的具有預測匯率能力，恐得經由時間考驗。這也是一般實證的發現，短區間很少有預測性證據，但長區間則常常有如此證據。可是，以邏輯而論，若長區間得以發現預測性證據，其必經短區間逐期累積而得，因此在短區間中亦應有所累積才得以在長區間被發現。這代表，短區間的資料中沒有確切證據支持基本面的預測力卻是值得挑戰與思考。在我的研究中，組合估計式是用來挑戰短區間基本面變數未有預測力的重要計量工具。Prof. Hansen 是這類估計式重要的領導學者，也成了我的請益對象。

在時間相當短促下，Prof. Hansen 還是很快就瞭解我論文的意旨、貢獻與潛在問題。他一下子就點清，若是要利用組合估計式進行預測力檢定，最重要的就是要有相對應的漸近理論。而在文中這部份的理論或立論根基是的確缺乏。這無疑是此行非常重要的收穫與啓示。在這次訪問剩下的時間中，我最重要的任務就是不斷思索如何建立該理論，雖無具體大結果，但也整理出若干頭緒與方向。

行政院國家科學委員會補助國內專家學者出席國際學術會議報告

98 年 7 月 11 日

報告人姓名	郭炳伸	服務機構及職稱	國立政治大學國貿系教授
時間 會議 地點	26-27 June, 2009 International Financial Center Central, Hong Kong	本會核定 補助文號	NSC 98-2752-H-004-001-PAE
會議 名稱	20th Annual East Asian Seminar on Economics		
發表 論文 題目	Price Pass-Through, Household Expenditure and Industrial Structure: The Case of Taiwan		

一、參加會議經過

The East Asian Seminar on Economics 係美國經濟研究局 (NBER) 每年度在亞洲固定舉辦的學術會議。該會議採邀請方式，並未對外廣為徵求論文，因此規模小且精緻。NBER 每年都會按照當時最重要的經濟時事擬定會議主題，並據以邀請各亞洲國家學有專精的學者撰稿論述。今年的會議主題為"Commodities Prices and Markets"，係著眼於去年全球性的通貨膨脹與原物料高漲現象。由於通貨膨脹或物價係中央銀行所關切事務，所以今年 NBER 與香港科技大學合辦，並選在香港貨幣局 (Hong Kong Institute for Monetary Research，相當於香港的中央銀行)內舉辦。香港貨幣局特別選擇面向維多利亞灣的會議中心，作舉辦場地。無論場地或議題皆是首選，加上為閉門會議，二天下來，頗有收穫。會議中共計發表 10 篇論文，為了充分達到討論，舉辦單位很不尋常地就每篇論文邀請兩位評論員講評，讓不只作者，而且與會者皆可充分瞭解每一篇論文的精義與可能發展方向。

二、與會心得

這次的「閉門會議」經驗，是第一次。相對於大型會議，這當中最主要的差異，在於閉門會議舉辦者要求所有與會者不得中途離席，並且又有經驗的評論學者就發表論文討論優缺點，腦力激盪不斷，實質收穫相當豐碩。

若以我們在本次會議宣讀的論文過程為例，"Price Pass-Through, Household Expenditure and Industrial Structure: The Case of Taiwan"，可以相當程度驗證前述心得。在這篇論文中，我們企圖以量化的角度，精準衡量台灣物價轉嫁行為究竟如何因產業結構改變而有如何的變化，以及其對家計單位的消費支出又產生如何的影響。我們在文中的研究焦點係針對外生的石油價格衝擊對台灣經濟在消費支出與產業結構所造成的連鎖反應。因此第一階段我們先行估計歷年來外生的價格衝擊對台灣各產業的價格影響程度。而在第二階段，我們利用第一階段所估計而得的價格轉嫁幅度作為模擬的內定參數值，並設計不同的實驗嘗試回答不同外生的物價衝擊對台灣各層面的影響。

我們發現，隨著台灣產出愈向服務業傾斜時，外生的油價衝擊則越形減少。但即便是這樣直覺結論，仍然引起在場參與者的討論與建議。歸結在場的對話，可為下列幾個重要方向：

(1) 估計物價轉嫁程度時，為何不加入其他控制變數？當中是否有結構改變？
(2) 在模擬試驗時，是否有考慮貨幣政策的預期效果？
(3) 在模擬試驗時，是否有討論產業間的替代效果？
(4) 在進行模擬時，似乎未考慮勞動市場的回饋反應？

我們對這些問題的感覺，事實上是感謝遠高於當下的難以回應。原因是我們在模型上的設計並未有類似機制，但更嚴重的是，我們一開始就假設這些機制對台灣經濟未能造成影響，而未考慮於模型當中。這是一次很好的會議經驗。每一篇文章，都經過仔細討論與檢視，受惠者不只是作者本人，更及於在座的所有參與者。我相信，與會者都像我一般，期待下一次的會議。

三、考察參觀活動(無是項活動者省略)

無。

四、建議

五、攜回資料名稱及內容

本會議議程。

六、其他

無。

行政院國家科學委員會補助國內專家學者出席國際學術會議報告

98 年 8 月 16 日

報告人姓名	郭炳伸	服務機構及職稱	國立政治大學國貿系教授
會議時間地點	August 3-5, 2009 the University of Tokyo	本會核定補助文號	NSC 98-2752-H-004-001-PAE
會議名稱	2009 Far East and South Asia Meeting of the Econometric Society		
發表論文題目	A Simple Hybrid Bootstrap Test for Predictive Ability Based on Autoregressions		

一、參加會議經過

今年(2009)的計量經濟學年會(Econometric Society)的遠東會議選在日本東京大學舉辦，並由該校經濟系主理所有會議籌辦行政，與排程事宜。東京大學在全世界綜合大學排名赫赫有名，在亞洲似乎是一可以與其他歐美頂尖大學一較高下的大學。東京大學在各領域表現均極為傑出，甚至擲世界牛耳。該校經濟系在全球學術表現亦不遑多讓。該系過去以數理經濟，與個體理論的相關應用，邇名世界經濟學術界。該系多名教授曾任計量經濟學會要職，影響力甚為深遠。近年來，該系亦注重實證分析，因而招聘計量方面學者。這次會議主辦人之一 Ichimura 教授即是在個體計量領域負有盛名的重量級研究者。

東大負有盛名，在於其歷史久遠。走進校園，巴洛克式的建築比比皆是，學術的獨立嚴謹儼然而生。更令人驚奇的是，東大大部分校園為高聳的銀杏樹覆蓋，到處綠蔭，即便外頭氣溫節節高昇，一進入校園沁涼馬上襲來，心情頓時沈澱，也難怪東大學術生產力如此之高。

二、與會心得

這次在會議中，有關計量的發表主題仍然分散，未見有新興有趣的議題。以 Bootstrap 方法進行探討的文章，共只有 3 篇。在現場時，又有發表人缺席，所以我那一場發表文章只剩下 2 篇。但或許主題吸引人，前來聆聽有 10 來多人。這對於這麼早的發表人而言，似乎已經是相當溫馨的鼓勵了。

當我報告完後，當場便有 4 人發問並評論。大多數都表示我的 Bootstrap 相當有意思，想要進一步了解如何執行該重覆抽樣程序。但其也評論表示我的抽樣是否有理論證明其嚴謹性。經過我的再三說明，似乎都能澄清他們心中的疑慮。事實上，我認為這次所發表的文章，不只在方法上有一定的創新，而且也建立其理論嚴謹性，應有不錯的機會將之發表於國際期刊。

與我同場發表的另一篇文章主題與我類似，但加入結構性改變。或許是英文程度的差異，

其發表後的回應則相對不熟絡。有趣的是，該文章所強調因為結構性改變，遠成預測檢力的下降等問題，適巧可由我所提出的抽樣方法加以解決。這是因為我所提出的抽樣方法在適用範圍上，已涵蓋結構性改變此一情況。在會後，我將我的想法與原委告知該作者。很顯然地，他沒有預測他所討論的問題，已不再是問題。

三、考察參觀活動(無是項活動者省略)

無。

四、建議

無。

五、攜回資料名稱及內容

本會議議程。

六、其他

無。

行政院國家科學委員會補助國內專家學者出席國際學術會議報告

99 年 9 月 7 日

報告人姓名	郭炳伸	服務機構及職稱	國立政治大學國貿系教授
會議時間地點	August 17 – 21, 2010 上海交通大學, 中國	本會核定補助文號	NSC 98-2752-H-004-001-PAE
會議名稱	2010 World Congress of the Econometric Society (世界經濟學大會)		
發表論文題目	Gaussian Inference in General AR(1) Models Based on Long Difference		

一、參加會議經過

此次大會係由上海交通大學安泰管理學院承辦。辦理這樣 5 年一次國際性大會議著實不是很容易，再加上本次大會據稱是經濟學界有史以來參加人數最多的一次會議，會議流程與人員管控恐怕得費盡心思。會議是在瀕臨黃埔江的上海國際會議中心，該中心氣派非凡，雖有數百人在裡面活動，可是不顯擁促。會議從 8 月 17 日至 8 月 21 日止，共為時 5 日。在同一時段，至少有 30 個節次發表論文。參與者若未選定節次聽講，恐怕會有琳瑯滿目，走馬看花的不真實感覺。

二、與會心得

我的論文被安排在 19 日下午第 1 場次。有趣的是，到場聆聽學者頗多，而且演講後的自由發問高達 7、8 人次，該論文的結果似乎頗引起共鳴。

但此行收穫最大的在於研究靈感的產生。有學者提出測試單根的新檢定。其想法是具有單根的時間序列由於其係長記憶性質，若以光譜頻率(spectrum)分析，其訊息應在低頻具有一定成份。該學者遂提出利用小波(wavelets)分析，分離此些低頻或長期性質的訊息。一旦這些低頻訊息可以被有效分解，使得用以建構新式單根檢定。這是一個迥異於一般單根檢定的想法。傳統單根檢定皆以時間範疇(time domain)利用係數估計，建構檢定，但卻忽略單根在光譜的低頻性質。

在金融財務實證文獻中，「預測性迴歸」(predictive regression)常被採用。從其所應用的時間序列中，我們似乎可提煉出類似低頻的訊息，並用以建構新檢定。以國際金融文獻為例，最經典的研究主題之一，一直圍繞在總體變數是否具有足夠的預測匯率變化的能力。不幸的是，總體變數變化緩慢，若真能預測匯率，該預測力將會被匯率變化中的短期噪音所覆蓋，而不容易分辨。這似乎也解釋文獻上在這方面研究發現的莫衷一是。但是總體變數的預測力其實正是長期且低頻的訊息，而被噪音覆蓋的匯率變化也正是這類長期而低頻的訊號，這讓前述的小波訊息分解有所著力。我認為這樣的想法將使「預測性迴歸」的研究方向截然不同，也可以規避既有文獻利用時間序列分析所產生的種種問題。這將是一個令人期待的研究新主題。

三、考察參觀活動(無是項活動者省略)

無。

四、建議

無。

五、攜回資料名稱及內容

本會議議程。

六、其他

無。

無研發成果推廣資料

98 年度專題研究計畫研究成果彙整表

計畫主持人：郭炳伸	計畫編號：98-2752-H-004-001-PAE
計畫名稱：貨幣、匯率與動態均衡之學術前沿研究--子計畫七：匯率預測：估計風險之角色(4/4)	

成果項目			量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）
			實際已達成數（被接受或已發表）	預期總達成數(含實際已達成數)	本計畫實際貢獻百分比		
國內	論文著作	期刊論文	0	0	100%	篇	無。
		研究報告/技術報告	0	0	100%		無。
		研討會論文	0	0	100%		無。
		專書	0	0	100%		無。
	專利	申請中件數	0	0	100%	件	無。
		已獲得件數	0	0	100%		無。
	技術移轉	件數	0	0	100%	件	無。
		權利金	0	0	100%	千元	無。
	參與計畫人力（本國籍）	碩士生	0	0	100%	人次	無。
		博士生	2	2	100%		陳致綱與莊珮玲。
		博士後研究員	0	0	100%		無。
		專任助理	0	0	100%		無。
國外	論文著作	期刊論文	0	0	100%	篇	無。
		研究報告/技術報告	2	2	100%		無。
		研討會論文	2	2	100%		無。
		專書	0	0	100%	章/本	無。
	專利	申請中件數	0	0	100%	件	無。
		已獲得件數	0	0	100%		無。
	技術移轉	件數	0	0	100%	件	無。
		權利金	0	0	100%	千元	無。
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	無。
		博士生	0	0	100%		無。
		博士後研究員	0	0	100%		無。
		專任助理	0	0	100%		無。

其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)	本研究成果在投稿後獲得的評審報告皆指出，研究所建議的估計式，固然在模擬時表現良好，但卻缺乏大樣本理論支持。這使得利用該估計式於匯率預測之實證研究亦受到質疑。若不論這些投稿「結果」，本研究一開始所設定的預定研究目標與成果，皆在本研究開展後大抵完成，而投稿所獲得的意見，有助於文章的改寫。

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

國科會補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■達成目標

□未達成目標（請說明，以 100 字為限）

□實驗失敗

□因故實驗中斷

□其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文：□已發表 ■未發表之文稿 □撰寫中 □無

專利：□已獲得 □申請中 ■無

技轉：□已技轉 □洽談中 ■無

其他：（以 100 字為限）

無。

3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以 500 字為限）

本研究從一開始概念的發想、估計式的設計，模擬程式的撰寫，以至於將該估計式應用於匯率預測，曾遭遇不同的研究瓶頸或困難，但都得以克服，並完成預定目標。雖然最終在投稿未如預期，但對研究團隊卻是大量文獻閱讀與問題解決的經驗累積。此一學術經驗，預期在著手下階段或未來相關研究時，將有減少進入成本的幫助。