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Measurement problems in household international remittances

INTRODUCTION

Although remittances have been a standard component of the balance of payments for many years, it has not been until very recently that attention has come to focus on the need for greater accuracy in their statistical measurement. For the most part this is simply a reflection of the practical fact that in an environment of limited compilation budgets, priority in the assignment of resources is determined by the relative importance of BOP flows.

In most industrialized economies, for example, the net flow of remittances is outward, but does not represent a significant fraction of total BOP flows nor of GDP. Obviously it does not make sense to allocate scarce resources for the measurement of a phenomenon which is of limited macroeconomic effect in the host country, and where improved accuracy would have only a marginal impact on the overall BOP accounts. In these countries the

Paper prepared by K. Coates, Director General, CEMLA. The paper was presented at the Third Irving Fisher Committee Conference "Measuring the Financial Position of the Household Sector", BIS, Basel August 30th-31st, 2006.

traditional approach to the measurement of remittances has been that of estimation on the basis of certain demographic and behavioral parameters pertaining to the immigrant population, although lately there has been increasing resort to International Transactions Reporting Systems (ITRS) data and Direct Reporting Systems (DRS).

In many emerging economies, on the other hand, the net flow of remittances is inward and their macroeconomic impact is of substantial and growing importance (see Tables 1 & 2). Their effect must be considered by macroeconomic and monetary policymakers, thereby giving rise to the need for more accurate measurement. This poses a methodological challenge to central bank compilers, given the absence of established "best practices" in remittances measurement.

This paper discusses some of the issues involved in improving the accuracy of the remittances statistics, in the face of a daunting array of obstacles comprising conceptual aspects, the complex structure of the remittances market and their channels of delivery, the nature of the different sources of data and, of course, the limited budget availability for the task.

It begins by describing the growing importance of remittance flows to emerging economies in the Latin American and Caribbean (LAC) region, and their macroeconomic implications. It proceeds to discuss conceptual ambiguities and ongoing efforts to clarify them with a new set of definitions of remittances in a BOP context. The structure of remittances markets in the region is analyzed in an effort to provide some indication of the appropriate compilation methodology to be employed, while a survey of different data sources and their availability is presented as another determining factor in the choice of measurement techniques.

The tentative conclusions of this work recommend that, in our region, compilation efforts should focus on direct reporting systems by the main intermediaries in the remittances market, to be complemented by additional information stemming from the use of household surveys. Discrepancies arising from data confrontation with estimates from other sources, where possible, should be regularly employed as a means for re-evaluating the methodology.

These issues have arisen in the context of ongoing work by CEMLA and others to develop a compilation guide on remittances

for Latin American and Caribbean central banks, to be applied in a regional effort to improve information and measurement of remittance flows. The project is partially financed by the Multilateral Investment Fund (MIF) of the Inter-American Development Bank. A Working Group on Remittances (WGR) comprising 24 central banks from the LAC region is the implementing body, while technical guidance is provided by a Remittances International Steering Committee (RISC) composed of international stakeholder institutions and collaborating central banks. CEMLA provides the project Secretariat.

THE GROWING IMPORTANCE OF REMITTANCES

There appears to be a new element in modern migration that refers to the structure of the household. In traditional migratory patterns the family was eventually reunited in the host country, once the pioneer migrants had established certain stability of prospects. Remittances were a temporary flow of sustenance until the family regrouped geographically, at which point "remittance decay" set in.

Today, along with everything else, the household and the job market have gone global. Cross-border households are increasingly common, generating income where there is work to be found and spending it closer to home where the elderly and more dependent members remain. Many migrant workers do not intend to remain their entire lives in the host country, just their productive years. Remittances are merely a way of getting the money from where it is earned to where it is most needed. Contributing to this phenomenon are the vast improvements and declining costs in modern international travel, communications and financial transactions.

As a result, remittances tend to be more stable flows nowadays that do not drop off after a certain number of years. While there is a consensus that remittances are growing fast, with total international remittance flows estimated to surpass USD 200 billion for 2006, there is at the same time an underlying feeling that the statistical evidence is sketchy and that we are dealing more in the realm of orders of magnitude than accurate statistical measurement. There is also a presumption that the high growth rates we

are witnessing in recent years may be overestimating the actual situation, since they are probably also reflecting improved measurement procedures. The following table provides estimates of remittances to the LAC region, showing an average annual cumulative growth rate of 19% over the period 2003-2005:

TABLE 1. REMITTANCE INFLOWS TO LATIN AMERICA AND THE CARIBBEAN (USD BILLIONS)

Area	*2005*	*2004*	*2003*	*a.a.c.r (%)*
Mexico	20.0	16.6	13.3	23
Central America, Dominican Rep. & Panama	11.7	10.2	8.8	15
Andean Block (including Venezuela)	9.8	7.6	6.6	22
Caribbean and English-speaking	3.2	2.9	2.7	9
MERCOSUR	7.9	6.5	5.5	20
Total for region	*52.6*	*43.8*	*36.9*	*19*

SOURCE: MIF-IADB.

Regardless of the exactness of these figures, the fact remains that remittance flows now exceed the sum of Foreign Direct Investment (FDI) and Overseas Development Assistance (ODA) to the LAC region. In many countries they have displaced tourism and the main commodity exports as the largest credit item on the BOP current account, and in several of the smaller economies their equivalence in terms of GDP is in the double digits (see Table 2)[1] with the consequent impact on GNDI.

The economic importance of these flows, both at the micro and macro levels, must be taken into account by policy-makers in view of their positive development impact in various ways:

— First and foremost, by permitting remittance recipients to accede to higher levels of consumption and improved living standards, including better health and education, these flows are contributing to the long-term development potential of the economy.

[1] While the flows in Table 2 refer to Total Current Transfer Receipts, the "workers remittances" component accounts for, on average, 80% of the total.

— Secondly, and given the role played by the banking sector as either a direct or indirect intermediary in the remittance process, these flows represent an opportunity for broadening the financial inclusion of beneficiaries, providing access to bank credit for housing and microfinance to the lower-income population segments.

— Last but not least, by strengthening the balance of payments and relaxing the traditional foreign exchange constraint faced by these economies, the a-cyclical nature of remittance flows improves creditworthiness and access to international capital markets, while reducing the cost of new debt.

CENTRAL BANKS AND THE NEED FOR MORE ACCURATE MEASUREMENT OF REMITTANCE FLOWS

There are several good reasons why central banks should be directly concerned with the improved statistical measurement of remittances, but above all there is a practical aspect relating to a specific responsibility: central banks in our region are the primary compilers and main purveyors of economic and financial statistics to the government and the market. While the scope of this responsibility may vary from country to country, it encompasses at the very least, monetary, financial and balance of payments statistics, and in many cases extends to national accounts and price indices. From the operational viewpoint, however, there are primary central bank mandates that justify close involvement in the monitoring and measurement of remittances:

— In the narrow terminology of payments systems analysis, what we commonly call remittances are in fact "small-value, cross-border, household-to-household transfers". As such they are of limited interest from a systemic viewpoint, in that their clearance and settlement should not normally pose a threat to the integrity of domestic payments systems, which is in many instances throughout the region a direct central bank responsibility under its mandate for financial stability.

— It is their cross-border nature which makes them interesting to central banks, since that makes them fall squarely in the province of the international balance of payments. Remittances also

TABLE 2. CURRENT BOP TRANSFERS TO LAC COUNTRIES, 1995 AND 2004

BOP Current Transfer Receipts			
USD millions	*1995*	*2004*	*As % of GDP*
Argentina	823	1,091	1
Aruba	71	40	
Bahamas, the	25	265	5
Barbados	57	127	5
Belize	38	54	5
Bolivia	248	488	6
Brazil	3,861	3,582	1
Chile	482	1,395	1
Colombia	1,033	3,917	4
Costa Rica	165	371	2
Dominican Republic	1,008	2,672	14
Ecuador	506	1,913	6
El Salvador	1,393	2,634	17
Guatemala	508	3,049	12
Guyana	67	140	18
Haiti	553	907	26
Honduras	244	1,359	18
Jamaica	670	1,892	22
Mexico	3,995	17,124	3
Netherlands Antilles	366	320	11
Nicaragua	138	619	14
Panama	184	323	2
Paraguay	200	196	3
Peru	837	1,467	2
Suriname	13	76	7
Trinidad and Tobago	34	101	1
Uruguay	84	98	1
Venezuela	413	180	0
Anguilla	22	9	
Antigua and Barbuda	78	23	3
Dominica	16	21	8
Grenada	22	32	7
Montserrat	14	28	
St. Kitts and Nevis	23	28	7
St. Lucia	28	29	4
St. Vincent & Grenadines	17	24	6
Regional total	*18,236*	*46,594*	*3*

SOURCE: IMF, BOP Statistical Yearbooks, as presented in John Wilson, "Manual On Best Practices for the Compilation of International Remittances" (Draft), CEMLA, July 2006.

occur within borders (for example, from the North to the South of Italy), but do not provoke very much interest in that context. In addition, the fact that as unilateral and unrequited transfers they are non-debt-creating flows adds to their fascination.

— The balance of payments is very much central bank territory since it has impact on the exchange rate and the level of reserves, which are both primary preoccupations of the monetary authority. This in itself is a strong justification for greater central bank scrutiny of remittances as flows that are increasingly influential in the determination of both, as well as on the fiscal implications of monetary sterilization. As a growing component of the balance of payments, therefore, remittances warrant more focused attention and greater precision in their measurement.

— As implied above, their impact goes beyond the narrow confines of the exchange market, and ventures into the mainstream of monetary and interest rate policy. For the many central banks in the region who have adopted inflation targeting as a monetary policy regime, inflation forecasting must take into account the pass-through to prices from movements in the exchange rate.

— From a national accounts viewpoint, remittances increase the national disposable income of the receiving country over and above its gross domestic product. If remittance flows are underestimated, the estimation of such key variables as the national savings rate may be prone to systematic error. And since monetary policy must also take into account the deviation of actual from potential GDP, this is also an important consideration for inflation targeting regimes.

— For central banks who still act as financial agent for the Treasury, the availability of foreign exchange for debt service should be of major interest (despite that today the dollar is at an anomalous discount rather than the traditional premium).

The case, then, for a better understanding and improved measurement of remittances is strong, although there are several important obstacles to be overcome in order for progress to be

made. These can be of a conceptual, operational or co-operational nature, as illustrated in the following list:

- Lack of agreement on a precise definition of remittances
- Discrepancy of information from different sources
- Lack of knowledge of market structures and channels
- Lack of registration for market operators (informality)
- Lack of precision in measurement techniques
- Little use of household surveys
- Insufficient resources at central banks and other agencies
- Insufficient coordination at the national and international levels

The need for improved measurement of remittances was emphasized at the 2004 G-8 Summit at Sea Island, and with this objective in mind the G-7 Ministers of Finance called for the establishment of an international working group on improving data on remittances. This group met for the first time in January 2005 at the World Bank in Washington.[2]

It was agreed there that the conceptual aspects of the challenge, focusing on the need for new BOP definitions of remittances, should be coordinated by the Technical Sub-Group on the Movement of Natural Persons (TSG), as part of the UN Interagency Task Force of Statistics in International Trade in Services. The TSG has prepared new definitions and submitted them to the IMF BOPCOM, the Advisory Expert group on National Accounts and the Interagency Task Force for approval.[3]

It was also agreed that the operational issues relating to the compilation of remittance data would be referred to a "city group" of BOP compilers. Thus the Luxembourg Group met for

[2] See "International Working Group on Improving Data on Remittances: Interim Report", World Bank Development Data Group, IMF Statistics Department and UN Statistics Division, November 2005.

[3] See "Outcome Paper: Definition of Remittances" (draft), TSG June 2006.

the first time at Eurostat headquarters in June 2006, and is now in the process of preparing an annotated outline for a manual on compilation guidance.[4]

CONCEPTUAL AND DEFINITIONAL ASPECTS

Part of the problem of measurement lies in the contemporarily employed definitions contained in BPM5,[5] which tend to reflect the static post-war world of limited capital and labour mobility where cross-border financial transactions were subject to control and immigrant status was clear-cut. The situation today is very different, and from the recipient countries' perspective the need is to quantify these flows with greater precision and determine their macroeconomic impact on the home economy, rather than to inquire as to the specific source of the funds or the duration of residence in the host country of the remitter.

The current "narrow" BOP definition of remittances presents three major shortcomings: *i)* from a formal viewpoint, the accounting for different components has different implications for 1993 SNA in terms of GDI and GDNI; *ii)* from the perspective of coverage, the definition excludes certain transactions whose nature and economic impact would suggest, in a contemporary context, that they should be included as "bona fide" remittances; and *iii)* from the measurement angle, certain conceptual ambiguities regarding the term "migrant" provide compilers with little practical guidance on the classification of transactions into the different categories.

The current account items[6] associated with remittances in BPM5 are the following,[7] although only the first two are traditionally included in working definitions of the term:

[4] See "Main Conclusions of First Meeting", Luxembourg Group on Remittances, July 2006.

[5] "Balance of Payments Manual", 5th Edition, IMF.

[6] BPM5 also includes "Migrants' Transfers" as a capital account component, reflecting an imputed transfer of net assets and liabilities of a household that changes residence status, although the link to remittances is tenuous.

[7] For an in-depth discussion of BOP remittance definitions and their relation to SNA 1993, see "Issue Paper #1: Definition of Remittances and Relevant BPM5 Flows", Alfieri, Havinga & Hvidsten, United Nations Statistics Division, February 2005.

— *Compensation of Employees*. This item refers to the earnings of short-term (less than one year) and cross-border workers, i.e. non-migrants. Their gross earnings are booked as a credit to the home country (country of origin), while their personal expenses abroad are debited under "travel", and taxes and social security contributions paid in the host country under "current transfers". Thus there is an imputed "net remittance" on current account, although this does not reflect actual financial transaction flows.

— *Workers' Remittances*. This is the lion's share of remittances, and is defined as "*current transfers by migrants who are employed in new economies and are considered residents there*" (i.e. have stayed or intend to stay for more than one year). In contrast to the previous item, workers' remittances refer to the actual cross-border transfers of funds to households in the country of origin. The empirical difficulties of identifying and measuring these flows are compounded by the following issues: *a)* The transfers refer only to income from employment, excluding other possible sources of funds; *b)* The definition refers to transfers from "migrants", which is a descriptive term rather than a clearly defined category such as legal resident or non-resident; *c)* there is a presumption of family relationship between the parties, which is difficult to establish in practice; and *d)* the remitter universe is confined to employed migrants, excluding all others from this category.

— *Other Current Transfers*. This is a "catch-all" category aimed at including all current transfers that do not originate from the employment income of migrant workers. As such it has not normally been added to the working definition of remittances, although as pointed out in the previous section, there are many transactions excluded by the definition of workers' remittances that both common parlance and economic analysis would tend to treat as remittances. These include other household-to-household transfers (gifts, dowries, inheritance, alimony), but also comprise transfers involving other institutional sectors such as the government (social security contributions and payments, taxes), NPISH or Non-profit Institutions Serving Households (charitable donations) and corporations (lotteries, private pensions, etc.).

The TSG has recommended several modifications to the BOP presentation of remittances, aimed at eliminating some of these problems. The main thrust of these modifications, in consonance with the analytical need to concentrate on the economic impact of remittances, is to increase the focus on the beneficiary household and de-emphasize the "migrant" status of the remitter. The new definitions build up step-by-step (see Figure 1) according to the source of funds received by the beneficiary household, as follows:

— *Personal Transfers*. This item would replace "workers' remittances" as a standard BOP item. Personal transfers are defined as *"all current transfers in cash or in kind made, or received, by resident households to or from other non-resident households."* They would therefore include all household-to-household current transfers, regardless of the remitter's source of funds, relationship to beneficiary or motivation.

— *Personal Remittances*. This item is defined as *"Personal transfers + net compensation of employees + capital transfers*. This is a broader household-to-household concept than personal transfers. Short-term and cross-border worker compensation is included on a net rather than gross basis, together with capital transfers between households.

— *Total Remittances*. This item completes the concept of total *direct* remittances received by households by incorporating non-house-

FIGURE 1. NEW BOP REMITTANCE DEFINITIONS RECOMMENDED BY TSG[8]

<table>
<tr><td colspan="5">Total Remittances</td><td colspan="2"></td></tr>
<tr><td colspan="4">Personal Remittances</td><td rowspan="3">Social Benefits</td><td colspan="2">Transfers to NPISH</td></tr>
<tr><td rowspan="2">Net Compensation of Employees</td><td colspan="2">Personal Transfers</td><td rowspan="2">Capital transfers between Households</td><td rowspan="2">Current Transfers to NPISH</td><td rowspan="2">Capital Transfers to NPISH</td></tr>
<tr><td>Resident Workers' Remittances</td><td>Other Household-to Household Current Transfers</td></tr>
</table>

[8] The chart presentation is adapted from René Maldonado, "Problemas en la Medición de Remesas", CEMLA, 2006.

hold sector remitters. It is defined as *"Personal remittances + social benefits"*, with the latter payable directly to households by governments, corporations or NPISH.

— *Total Remittances and Transfers to NPISH.* This final item, which is self-defining, rounds out the concept of total cross-border support to households by recognizing that some of it may be received indirectly through the intermediation by domestic NPISH of funds received directly from abroad.

REMITTANCES AND THE HOUSEHOLD FINANCIAL POSITION

As mentioned above, the TSG has recommended the adoption of a new standard item "*personal transfers*" to replace the BPM5 component "workers remittances". Personal transfers are defined as "*all current transfers in cash or in kind made, or received, by resident households to or from other non-resident households.*" By adding the *net compensation of employees* and *capital transfers between households* to personal transfers, a concept of "*personal remittances*" is arrived at. The further addition of *social benefits* provides a concept of "*total remittances*".

All these items have in common that the direct beneficiary is a household, although the senders may either be other households (in the case of personal transfers, net compensation of employees and capital transfers between households) or governments and corporations (social benefits). Most are *flow* concepts, with the exception of capital transfers between households which add and detract from *stocks*.

Capital transfers are defined as those which transfer ownership of fixed assets, or funds conditional on the purchase or disposal of fixed assets by either or both parties. Clearly these are more likely to contribute to the financial position of households, to the extent that the latter contemplates the ownership of fixed assets.

The additional income represented by the flow concepts, however, may raise total beneficiary household income above the zero savings threshold and allow for the accumulation of financial assets. Since the remittance beneficiary households are likely to be concentrated in the lower income segments of the population, it would appear reasonable to assume that the flow concepts will be

directed mostly towards consumption. However, to the degree that remittances may catalyze the inclusion of beneficiary households in the formal banking sector, their impact on the financial position of these households may be more significant.

Distinguishing among personal and capital transfers between households for purposes of compilation will prove challenging. While the former are likely to be smaller and periodic, the latter will tend to be larger and less frequent. In this context the data provided by ITRS and direct reporting systems may require complementary information arising from household surveys that include sections on remittances. For this purpose the International Working Group to Improve Data on Remittances recommended that the International Household Survey Network could provide a useful tool in comparison of data, metadata and methodology.

THE STRUCTURE OF REMITTANCES MARKETS

While the conceptual simplification provided by the new definitions should improve matters (and certainly make them no worse) as far as knowing which flows are to be measured and included under the different categories of remittances, the actual compilation methodologies to be employed will depend on the availability of data.

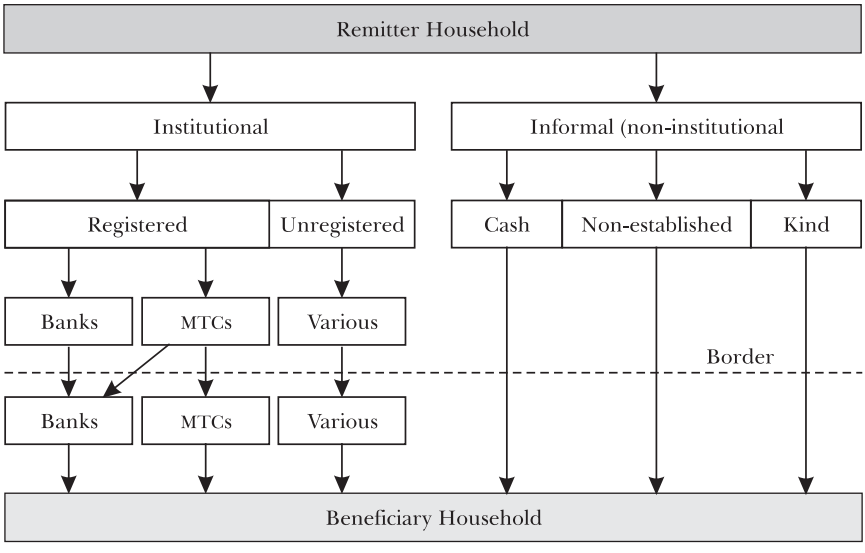
Understanding a concept is no guarantee of the ability to measure it precisely. Everyone understands the concept of trade in foreign merchandise, and it is generally accepted that customs data are a good proxy for the flows in question. However, it is also recognized that customs do not verify 100% of the contents of bills of lading, that invoicing may not be entirely transparent and that a certain amount of "informal" trade does not pass through customs.

Similarly, a more precise measurement of remittances will require a better understanding of the channels through which they flow, and the relative importance of each. This is liable to vary by national markets, according to such factors as regulation (or the absence of it), financial inclusion, cost, available payments systems technology and even cultural habits.

The following Figure 2 illustrates in a very schematic manner the various channels through which personal remittances may

flow from origin to destination.[9] As with international trade, a primary distinction is drawn between institutional and informal channels, the former comprising the delivery of remitted funds through established business entities whether or not they are authorized to engage in such activity. The informal channels consist mainly of the physical transportation of cash or gifts brought into the home country by individuals (the actual remitter, friends and relatives, or couriers), or the use of non-established outfits such as the "hawala" type systems.

FIGURE 2. POSSIBLE CHANNELS OF DELIVERY FOR PERSONAL REMITTANCES



Within the institutional channels there are registered and unregistered intermediaries, the latter consisting of entities formally established for other commercial purposes that offer money transfer services as an irregular side activity to their own cross-border transactions. They should not be confused with the agent network of the registered intermediaries, which usually consists of small commercial establishments on both sides of the border operating under contractual, commission-based arrangements.

The registered intermediaries themselves are banks (as well as other depository institutions) that offer international money

[9] Adapted from John Wilson, *op. cit.*

transfer services in their product menu, and the specialist money transfer companies (MTCs) such as Western Union or Moneygram. Some MTCs use banks for the actual cross-border transfer of funds from the gathering points to the distribution centre, as illustrated by the diagonal arrow in Figure 2.

Clearly the availability and quality of data from registered intermediaries is far superior to that from others. This provides a strong justification for regulators to require registration and impose obligatory reporting requirements on companies wishing to participate in the remittances industry. To the extent that the industry is able to provide sound, efficient, cost-effective, competitive and transparent services,[10] the incentive to resort to unregistered or informal channels should be reduced, and the quality of statistical coverage should improve.

Data on the unregistered and informal channels must obviously come from the users rather than the providers, and it is in this context that household surveys at both ends of the remittance corridors can prove useful in estimating the overall volume of the flows and arriving at approximate conclusions regarding the market shares of the different channels. The following table provides illustrative figures for remittances markets for selected Latin American recipient countries and for the USA and Japan as originating markets.

The first point to be made regarding Table 3 is that the figures should be interpreted with some caution. Beneficiary respondents receiving payment through bank branches may not be sure if the bank is acting on own account or as an agent for an MTC. Other channels may not be entirely informal or unregistered (for example, the use of the postal system or courier services), and may even include some of the more innovative delivery systems (such as stored value card ATM withdrawals) that the respondent does not associate with a depository institution.

Nevertheless, some clear conclusions may be drawn: *a)* while informality is a non-negligible factor in most markets, the bulk of transactions flows through registered institutional channels; *b)* with the exception of the Japan-Brazil corridor, MTCs appear to

[10] See "General Principles for International Remittances Services" (draft), The World Bank and the Committee on Payment and Settlement Systems (BIS), March 2006.

TABLE 3. REMITTANCE DELIVERY CHANNEL SHARES IN SELECTED LAC RECIPIENT AND ORIGINATOR MARKETS

Recipient markets	*MTC* (%)	*Banks* (%)	*Other* (%)
Bolivia	29	33	38
Brazil	1	94	5
Dominican Republic	79	9	12
Ecuador	68	16	16
El Salvador	47	34	19
Guatemala	79	7	14
Honduras	64	18	18
Mexico	47	44	9
Originating markets			
United States	79	8	13
Japan		93	7

SOURCES: MIF-IADB Survey of Remittance Beneficiaries, as reported in Manuel Orozco, "Conceptual Considerations, Empirical Challenges and Solutions for the Measurement of Remittances", CEMLA, August, 2005; and Bendixen & Associates, presentation by Sergio Bendixen, "Understanding Remittances to Latin America", at Joint Conference on Remittances, ADB, Manila, Philippines, September 2005.

have a significantly larger market share than banks throughout the region; and, *c)* market structure by channel can vary significantly from country to country, both within the region and in originating countries (in this respect, the contrast between USA and Japan is striking).

The multiplicity of delivery channels and participants is not the only structural aspect of remittances markets that complicates measurement, however. Other structural features of institutional channels to be considered from a compilation viewpoint are:

— The very high number of very low value transactions.

— The large networks of originating and delivery agents on both sides of the border.

— Funds do not always flow in a direct path from remitter to beneficiary. MTCs often use banks as origination and payment agents, and must use them for the actual cross-border transfer of funds.[11]

[11] In certain cases (such as the US-Mexico ACH "Directo a México"), central

— Batching and netting of transactions at the agent, MTC and bank levels makes it difficult to interpret raw data on financial flows.

— Geographical allocation of origin is sometimes hindered by the use of regional processing centres by intermediaries.

— At some point in the flow there is normally a currency conversion, which can involve new parties to the transaction.

In this context, following the intertwining "flow of funds" may prove frustrating for compilation purposes. Fortunately, however, the "information flows" are far more transparent than the "financial flows" and must remain under control of the service provider throughout the entire transaction. At the very least the service provider must retain data on origination, amount, destination and payment mode.

DIFFERENT APPROACHES TO REMITTANCE COMPILATION

As mentioned at the outset, different countries employ different compilation methodologies, or some combination of them. The resources invested in these efforts can usually be related to the importance of remittances to the economy in question. The growing impact of remittance flows on recipient economies calls for an improvement in the methodologies employed, and the choice of compilation techniques should reflect the structure of the remittance markets in question and the data sources available.

It is in fact somewhat misleading to speak of compilation methodologies as if these were ready-made alternatives to be applied according to the particular characteristics or constraints of a given situation. It is more appropriate to think in terms of data sources, and perhaps then refer to "families of methodologies" according to the relative weight they attach to each data source.

The main *institutional* data sources for remittance compilation are the following:

— *International Transactions Reporting Systems*. The provision of ITRS data is for the most part a responsibility of the banking

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banks provide substitute facilities for private correspondent banking relationships.

system, with origins in exchange controls and more recent AML-CFT provisions. Banks are required by regulators to report individual cross-border transfers carried out on behalf of their customers (usually exceeding a given threshold level), and to provide information pertaining to the nature of the transaction and the origin or destination of funds in a standardized format. Given the advances in information technology, this reporting requirement places a low burden on the banking system and makes available to compilers a large volume of raw data at a low cost. Nevertheless, there are various shortcomings associated with ITRS data for the specific purpose of measuring remittances: *a)* since typically remittances fall beneath the reporting threshold,[12] they would be included in the lump sum reported for small transactions, thus making their extraction subject to estimation and creating the potential for misclassification; *b)* MTC financial flows through the banking system will be reported through ITRS subject to the netting, batching and geographical uncertainties mentioned in the context of financial flows; and *c)* the ITRS data does not cover flows through informal or unregistered delivery channels.

— *Direct Reporting Systems*. Given the difficulties of interpreting financial flow data through bank ITRS, a more attractive alternative from the compilation viewpoint would be to require institutional providers of remittance services to supply more detailed reports on a regular basis according to a pre-designed format, based on the "information flows" accompanying transactions. MTCs and banks directly engaged in remittance activity on own account would provide from their data bases a list of all transactions into and out of the national jurisdiction below a given "remittance threshold", including information on origin (geographical, institutional vs. personal) and mode of delivery (cash pick-up vs. credit to bank account). While this would allow for greater accuracy in identifying and estimating remittances through institutional channels, it would still not solve the "informality problem". Although it would imply a "start-up" burden for institutional reporters, once installed the run-

[12] Currently set at 12,500 euros in the Eurozone countries.

ning costs should not be excessive. From the compiler's perspective, DRS are superior to ITRS.

Despite the difficulties in interpretation, institutional data has the indisputable advantage of reflecting actual transactions and therefore providing more certainty. Other sources of data require a more inferential approach to compilation, relying more on estimation than actual measurement. In addition to institutional reporting systems, other sources of data are:

— *Household Surveys*. Information obtained from surveys can be very useful in complementing institutional data, especially since it can help estimate the degree of informality in the remittances market (thus allowing for the "grossing up" of institutional data) and provide information on innovative delivery channels. Information can be obtained by inserting appropriate questions (frequency, amount, mode of delivery, relationship to remitter, etc.) in existing household surveys in recipient countries, or by implementing independent surveys of migrant communities abroad or of travelers at border entry points. The main drawbacks of household surveys are that: *a)* they are costly from the sampling viewpoint, since neither remitters nor beneficiaries are distributed evenly among the respective populations; in this respect a sub-sample of positive respondents to a regular survey may be useful; *b)* the information obtained may be subject to "recall" uncertainties and upward/downward disclosure bias.

— *Demographic Data*. The existence of reliable statistics on migrant population abroad and immigrant population at home, combined with behavioral information obtained from surveys ("propensity to remit"), can provide broad estimates of both inward and outward remittance flows.

— *Counterpart Data*. This implies employing the data compiled by "partner" countries in cases where a geographical breakdown of remittances is available. Given the uncertainties attached to data quality and the various methodologies employed by compilers abroad, this does not appear as a reliable source for aggregation.

As mentioned above, different countries will have varying degrees of access to the different data sources and, what is more

important, may or may not be prepared to invest more time and effort in improving them. In all cases, even where institutional data is the main input, some degree of estimation will be required. This will call for certain assumptions that must be regularly checked and updated.

As far as remittance compilation methodologies are concerned, one can imagine a spectrum of possibilities ranging from the intensive use of directly reported institutional data complemented by informality estimates from household surveys, to a complete reliance on data models based on population statistics and behavioral parameters. Furthermore, different approaches may apply to the different components of total remittance flows.

In view of the particular features inherent to each market, it is difficult to recommend a standardized compilation methodology down to the last detail for universal adoption. However for regions and countries sharing common characteristics, a set of "best practices" aimed at harmonizing efforts with a view to promoting comparability and aggregation is both a feasible and worthwhile undertaking.

Given the preponderance of registered institutional delivery channels in the LAC region, and indeed the dominant market share of MTCs within them, there would appear to be a *prima facie* case for relying on direct institutional reporting as the primary source of quality data for purposes of statistical measurement of remittance flows to the region. Periodical household surveys should complement these efforts by providing additional information on informal delivery channels. All other available data sources should be regularly tapped upon to provide overall estimates of remittance flows through data models, as a means of confronting and validating results.

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A BVAR forecasting model for Peruvian inflation

1. INTRODUCTION

Explicit inflation targeting is being adopted by an increasing number of central banks and a great body of literature has highlighted the advantages of this approach for conducting monetary policy. Since 2002, the Central Bank of Peru has been performing an explicit inflation targeting regime (IT) by announcing an inflation target of 2.5% and adopting the standard operational and policy procedures implied by IT.[1] Especially since 2002, the

[1] In particular, a central feature of the Peruvian monetary policy in the 90's has been the acquired autonomy of the Central Bank and the pre-

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inflation forecast process has increased in significance to become one of the most important tasks in policy making.

With a fully-fledged IT regime adoption, staff at the Central Bank of Peru and elsewhere developed semi-structural models to forecast inflation.[2] The current core forecasting model at the Central Bank is the so-called MPT (*modelo de proyección trimestral*) which in fact is a mixture of calibrated and estimated semi-structural equations such as a Phillips Curve, a demand driven output gap equation, a forward-looking monetary policy rule for the interbank interest rate and so on. A typical forecasting exercise with this model comprises the input of the various sectorial experts that either provide assumptions or forecasts about the exogenous variables in the model. Hence the framework allows itself to judgemental information intervention which might not necessarily be present within the data.

Though, a usual criticism about this process is the non-replicability of the forecasts by agents outside the forecasting process who might happen to have the same model.[3] Therefore, this criticism calls for models that can in fact be independent of the forecaster, models parsimonious yet aggregate enough to have a rough understanding of the joint evolution of the relevant macroeconomic variables.[4]

We propose a VAR methodology with the following features: *a)* IT encompasses previous work on VAR modelling at the central bank of Peru, *b)* IT is suited to forecast aggregate variables, *c)* IT relies heavily on the data and priors about the data generating process.

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announcement of the inflation rate since 1994. For a comprehensive view of the implementation of inflation targeting in Peru see Armas et al. (2001).

[2] See for example Luque and Vega (2003) and Llosa (2004).

[3] Precisely, Inflation Reports are deemed to explain to the public the forecasts and assumptions lying behind them.

[4] Models trying to understand the transmission mechanism of monetary policy have been published at various points during the 90's and this decade, key aspects of these models have been the measure of monetary policy using money aggregates - e.g. Bringas and Tuesta (1997), León (1999) and Quispe (2000) Only recently have VAR type of papers focused on interest rates as the monetary policy instrument - e.g. Winkelried (2004) and Grippa (2004). Winkelried (2003) and Barrera (2005) develop models for forecasting inflation using disaggregated data. This approach is not suited for the task we pursue given that IT does not have a clearly defined joint process for the key aggregate variables of interest as VAR models.

Our purpose is achieved by estimating simple BVARs with Litterman assumptions for the priors about the parameters of the VAR. This allows US to input appropriate priors to the data generating process. As we see on the section about our data analysis, the economic time series have been the subject of possible breaks in regime which have rendered standard VAR models to forecast failure. By considering alternative BVAR specifications that can perform well in out-of-sample forecast exercises; we can set up a benchmark for the structural identification of the models.

We follow the approach in Doan et al. (1984) and Robertson and Tallman (1999) to evaluate forecast performance in our proposed models. We also discuss the forecast procedure in which we emphasize the complications that arise from the timing of data realizations. In particular, we perform the so-called conditional forecasting technique, as described in Doan et al. (1984). Up to four possible VAR models with increasing number of variables are considered. The smaller model (model 1) contains prices, real GDP, the real effective exchange rate, the nominal interbank rate and an index of commodity metals. The larger model contains the variables of model 1 plus the monetary base and a block of external variables comprising the FED funds rate, US CPI and the US industrial production index.

Importantly, the choice of hyperparameters is crucial in any Bayesian specification. In order to elicit our priors we use a novel feature that consists in using a rule to choose the tightness and decay parameters based on the distance between long-run (seven years ahead) forecasts of nominal variables and the respective nominal anchor the central bank aims at.

Our results show that the use of BVAR models to forecast inflation and GDP growth can significantly improve the performance over models that do not use judgment-based forecasts, for example a naive random walk. All competing models perform quite well compared with a naive random walk. Overall, the simplest BVAR (which includes CPI, GDP, interest rate, effective real exchange rate and external prices) outperforms other specifications, being robust to changes in both the sample and the judgment criteria.

The rest of the paper is organized as follows, in section 2 we provide the description of the main features of the macroeconomic data we use in our models, in section 3 we set up the BVAR specifications and we describe the ideas behind our choice of pri-

ors, in section 4 we provide results about our out-of-sample diagnostics and section 5 concludes and suggests the research agenda.

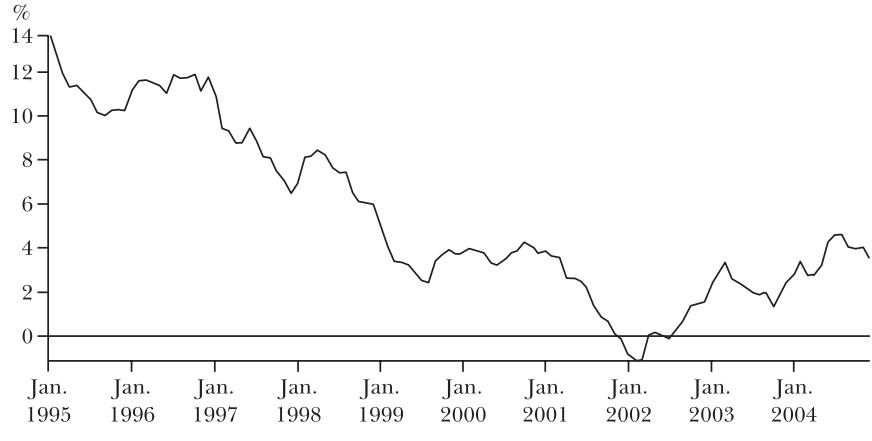
2. PERUVIAN MACROECONOMIC DATA

In this section, we briefly characterize the evolution of the main macroeconomic variables for the Peruvian economy during the period that spans from 1994 until late 2004. These variables belong to the set of main aggregate information the central bank uses in order to take monetary policy decisions.

We provide key facts, starting from some historical perspective about our main variables in order for readers to gather insight. Overall there is an important change in the cyclical behaviour of the main macroeconomic variables which to some extent were influenced by changes in both the monetary policy operating procedures and the fully-fledged IT regime adopted in 2002.[5]

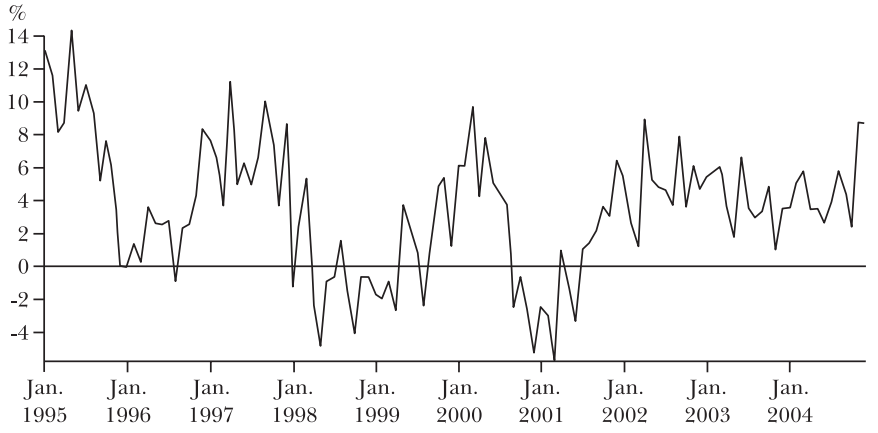
Figure 1 depicts the evolution of monthly CPI inflation rates measured as year on year log differences for the period 1994 until 2004. IT is clear from this figure that inflation has followed a downward trend from two-digit levels to even negative values at the end of 2001, period where the fully-fledged inflation targeting

FIGURE 1. YEAR-ON-YEAR HEADLINE INFLATION, 1995-2004



[5] Before 2002 the Central Bank of Peru has used different monetary aggregates as guides for monetary policy. Importantly, academics agree upon the less relevant role of money aggregates when interest rates are used as the instrument for monetary policy.

FIGURE 2. YEAR-ON-YEAR GDP GROWTH, 1995-2004



framework was adopted. From then on, there has been an upward movement towards an inflation rate between 2 and 4%. IT is believed that inflation has achieved a stationary situation, whereby shocks of any kind will make inflation revert to the nominal anchor established by the central bank. No doubt, the unconditional mean considering the entire sample size might not be accurate enough within this stationary inflation rate environment because data from the early part of the sample lacks the intrinsic property of a well-defined long run anchor. On the other hand, throwing data from the early sample implies discarding important information about short run dynamics of inflation.

Figure 2 shows the growth rate of monthly deseasoned GDP.[6] There is an important decrease in the volatility of this series, coinciding with the period the inflation targeting period has been in place. From 2002 onwards GDP growth has been always positive and ranging up to about 8%. In previous years this growth rate exhibited huge cyclical swings, ranging from -6% up to two digit levels.

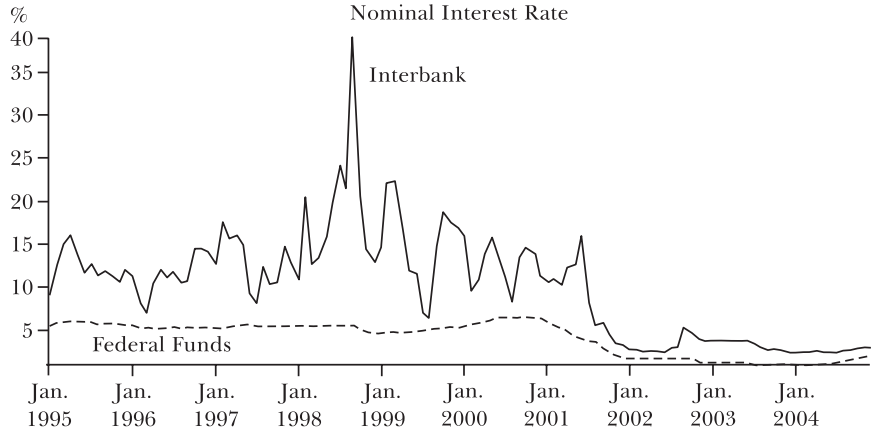
Another key macroeconomic variable which has significantly changed its behaviour across periods is the interbank interest rate.[7] Figure 3 shows the evolution of the interbank rate *vis-à-vis*

[6] The official statistical authority in Peru (Instituto Nacional de Estadística e Informática) reports monthly estimates of Peruvian GDP obtained from sectorial production. Given the nature of this estimate, IT is subject to constant revisions.

[7] Previous studies about the transmission mechanism of monetary policy for the Peruvian economy were not able to incorporate this variable due to the short span these data have existed.

the FED funds rate for the period of study. During the monetary targeting era the interbank rate exhibited a highly volatile pattern without any clear co-movement with the FED funds rate. Periods of high interbank rates coincided with episodes of financial distress, for example the adverse effects on capital flows resulting from the Asian crisis during 1998.[8] The recent period has witnessed a downward trend in the interbank rate volatility and its movements are more associated with those of the FED funds rate.

FIGURE 3. INTERBANK RATE AND FED FUNDS RATE, 1995-2004



In Figure 4 the evolution of money growth and CPI inflation are jointly presented. Again the change in the co-movement between these two variables is striking. For the period spanning from 1994 until 2001, the sharp fall in CPI inflation was linked with a persistent decrease in the monetary base growth rate. Interestingly, this relationship breaks after 2001 where both, an upward trend in base money growth and a steady level of inflation are observed. The previous result suggests, somehow, a less relevant role for money to explain inflation dynamics after the adoption of the IT regime.[9]

[8] IT is an open question if these interest rate hikes induced by the central bank were an optimal response that helped mitigate the effects of the external shock. The answers to this ever important question go beyond the scope of this paper.

[9] Remarkably, empirical work on monetary policy has reached the point in which IT is more natural to add commodity prices rather than money in VARs to improve forecasts. However, Leeper and Roush (2003) have recently found out,

FIGURE 4. MONETARY BASE GROWTH RATE AND YEAR-ON-YEAR INFLATION, 1995-2004

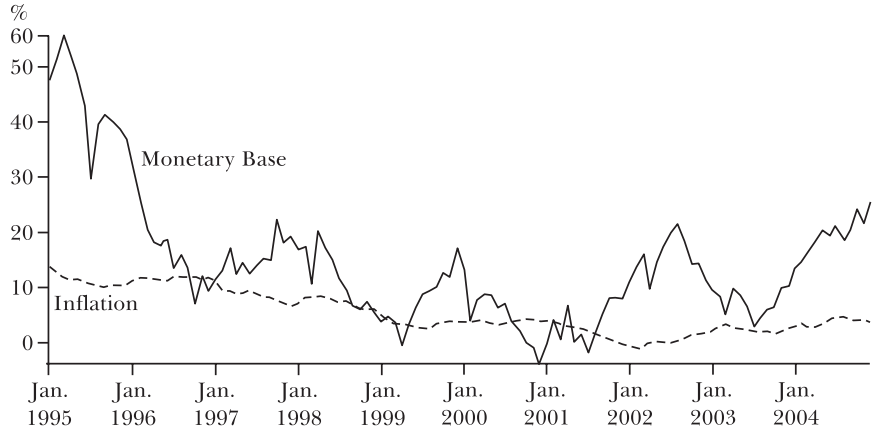


Figure 5 presents a panel of graphs showing the relationship between two commodity prices (oil price and metal price indices) with the terms of trade[10] and the effective real exchange rate.

In general, we observe two clear periods, the first part of the sample has the real exchange rate grossly moving in opposite direction to the terms of trade. Periods of low terms of trade are equivalent to periods with low relative export prices and hence with less favourable external price impacts on external balances. In those periods, the real exchange rate moved upwards in an accommodating fashion. After 2003 we observe a sizeable increase in the terms of trade and thereby affecting external balances positively, however the real exchange rate does not fall. Even though there have been factors pushing the Dollar to historical low levels *vis-à-vis* the majority of the currencies, the fact that the nominal exchange rate is less volatile than our trading partners (whose currencies have been appreciating faster against the dollar than the Sol) has generated a relatively constant real exchange rate.

The evolution of both metal and oil prices govern the dynamics of the terms of trade. Metal prices are a strong component of export prices while oil prices affect import prices the most. We ob-

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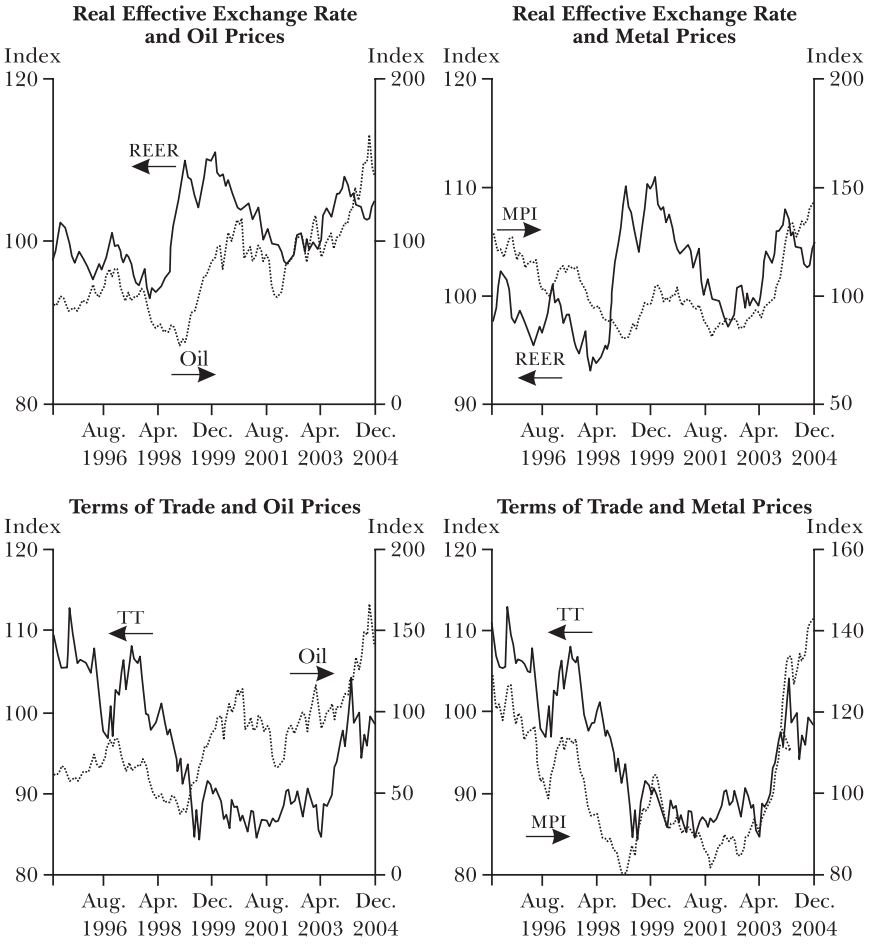
for the US, that the way money is modeled matters at explaining inflation dynamics after a policy shock.

[10] Measured as the relative price of exports against the price of imports.

serve that the terms of trade dynamics mimic closely metal prices, except for periods where oil price hikes are in place.

Oil prices on the other move somewhat closely to the effective real exchange rate series, capturing the fact that foreign prices are affected by oil price shocks.

FIGURE 5. REAL EFFECTIVE EXCHANGE RATE AND TERMS OF TRADE, 1996-2004



This graphical inspection to the data allows US to configure a set of variables to use in the VAR specifications. In particular, we favour the use of the metal price index instead of the terms of trade. On the other hand, the effective exchange rate has been moving along the oil price index and thus seems to be a good

variable for inflation forecasts purposes, let alone its possible effects on output.

IT seems that a switching regime is a feature of the data analysed so far. Table 1 confirms our graphical analysis, we note the properties of the data sometimes change dramatically from one sample to another; the first sample goes from January 1994 to December 2000 while the second sample includes the IT period.

Overall, unconditional means and volatilities fall towards the IT period. Differences in cross-correlations between the two periods

TABLE 1: KEY UNCONDITIONAL MOMENTS

	Sample		
	Early[a]	*Recent*[b]	*Whole*[c]
Mean			
CPI Inflation	0.63	0.15	0.47
Interbank Interest rate	13.32	4.72	10.43
Fed Funds rate	5.35	2.06	4.25
Standard Deviation			
Output	1.90	1.04	1.66
CPI Inflation	0.41	0.33	0.45
Δ in monetary base	2.31	1.54	2.08
Real effective exchange rate	3.14	2.11	2.86
Interbank Interest rate	4.70	3.39	5.92
First order autocorrelation			
Output	0.84	0.73	0.83
CPI Inflation	0.53	0.35	0.62
Interbank Interest rate	4.60	0.90	0.82
Cross correlation relative to output			
CPI inflation	-0.16	0.19	-0.02
Δ in monetary base	0.06	-0.10	0.04
Interbank Interest rate	0.01	-0.47	-0.00
Cross correlation relative to interbank rate			
Output	0.01	-0.45	-0.00
CPI inflation	-0.44	-0.16	0.09
Δ in monetary base	-0.15	-0.18	-0.08
Real effective exchange rate	0.09	0.05	0.18
Federal funds rate	0.11	0.81	0.73
Cross correlation relative to FED funds rate			
Output	0.25	-0.63	0.07
CPI Inflation	-0.19	-0.22	0.32
Interbank Interest rate	0.07	0.84	0.73

[a] 1994:01 to 2000:12. [b] 2001:01 to 2004:06. [c] 1994:01 to 2004:06.

are also important for some variables.[11] Interestingly, the cross-correlation between CPI inflation and the interbank interest rate has become less negative in the second sub-sample (shifting from -0.44 to -0.16). A second point to highlight is that the domestic interbank rate has become more correlated with foreign rates in the more recent period. During the first period the correlation between foreign rates and the interbank rate was 0.11 and the same correlation has become highly positive during the second period (0.81).

In conclusion, the seeming changes in regime observed in the data supports the idea of VAR modelling able to incorporate prior information. Classical linear VARs performed with these types of data may render in out-of-sample forecasts that are too poor to be of use. On the hand, a properly defined Bayesian VAR can perform better even in this environment.

3. MULTIVARIATE ANALYSIS

First, we specify the variables and the alternative BVARs. The variables defined are the deseasoned GDP at 1994 prices (y_t), the consumer price index in Lima city (p_t), the deseasoned monetary base (m_t), the monthly average interbank rate (i_t), the effective real exchange rate[12] (q_t), the monthly FED Funds rate (i_t^*), the monthly US industrial production index (y_t^*), the US core price index (p_t^*) and the index of the price of a set of metal commodities as published by the IMF (p_t^{cm}). All variables but interest rates are expressed in logs and then multiplied by a 100. On the other hand, as discussed in the previous section, the presence of p_t^{cm} is justified by the fact that IT is capturing that other bit that affects the terms of trade not impounded in the real exchange rate for this small open economy.

We run the VAR in levels given that non-stationarity of the variables are not a concern in Bayesian econometrics. IT would be

[11] Cross-correlations were adjusted following Forbes and Rigobon (2002) in order to correct the business cycle moment using estimates of standard deviation in the two sub-samples.

[12] The effective real exchange rate is calculated using a nominal effective exchange rate that considers the 20 most important trading country partners and the respective official consumer price indices.

better to run with as many lags as possible but the sample size hinders this approach so we settle on $p = 6$ lags.

The various model representations are depicted in the following table:

TABLE 2: BVAR SPECIFICATIONS

	y_t	p_t	m_t	q_t	i_t	i_t^*	y_t^*	p_t^*	p_t^{cm}
VAR 1	x	x		x	x				x
VAR 2	x	x	x	x	x				x
VAR 3	x	x	x	x	x	x			x
VAR 4	x	x	x	x	x	x	x	x	x

With these specifications in mind, the VAR models in general can be expressed as:[13]

$$[1] \qquad \begin{pmatrix} y_1 \\ \dots \\ y_T \end{pmatrix}_{T.k} = \begin{pmatrix} z_1 \\ \dots \\ z_T \end{pmatrix}_{T.\kappa} \Gamma_{\kappa.k} + \begin{pmatrix} u_1 \\ \dots \\ u_T \end{pmatrix}_{T.k}$$

Where y_t is a row vector of endogenous variables of size k, z_t is a row vector of size $\kappa = kp$ containing the lags of y_t up to the p-th lag: $z_t = \begin{bmatrix} y_{t-1} & \dots & y_{t-p} \end{bmatrix}$, u_t is a row vector containing reduced-form shocks with zero mean and covariance matrix Ψ and Γ is a matrix of parameters which contains κ rows and k columns $\Gamma = \begin{bmatrix} A_1 & \dots & A_p \end{bmatrix}$.

The left-hand side of Equation [1] is a matrix with T rows and k columns; if we pick the $i-th$ column of this matrix and its corresponding element on the right hand side we get the equation for the $i-th$ variable.

$$[2] \qquad y_i = Z\gamma_i + u_i$$

Here Z stacks the T row vectors z_t, y_i is a column vector of size T, γ_i is the $i-th$ column of Γ and u_i is the $i-th$ column of the matrix of stacked error row vectors u_t. We pile these k equations for all the endogenous variables to get the standard set up,

[13] We have chosen no to model constants, seasonal dummies and time trends.

[3] $$\begin{pmatrix} y_1 \\ \dots \\ y_k \end{pmatrix}_{Tk.1} = \left(I_k \otimes Z_{T.\kappa} \right)_{(Tk).\kappa k} \begin{pmatrix} \gamma_1 \\ \dots \\ \gamma_k \end{pmatrix}_{k\kappa.1} + U_{Tk.1}$$

Which takes the form of a general linear model as defined in Kadiyala and Karlsson (1997).

[4] $$Y = \mathbf{Z}\gamma + U$$

The parameter we are interest in finding is given by γ which is a collection of k column vectors containing all the parameters in each of the k equations in the system. The parameters γ can be solved using the standard least-square formulas or by MLE estimation. IT is straightforward to show that the parameter estimate is:

[5] $$\hat{\gamma} = \left(\mathbf{Z}'\mathbf{Z} \right)^{-1} \mathbf{Z}'Y$$

With covariance matrix:

[6] $$\widehat{\Psi} = Y'M_z Y$$

Where M_z is the well known matrix $M_z = I - \mathbf{Z}(\mathbf{Z}'\mathbf{Z})^{-1}\mathbf{Z}'$.

3.1 The Litterman specification

The number of parameters in our system is quite large; IT includes the length of the column vector γ which is given by $k^2 p$ namely, the number of equations multiplied by the number of regressands of their right hand side. The total number of variables also includes the $k(k+1)/2$ elements of the covariance matrix Ψ. Bayesian estimation requires US to have a prior distribution for all these variables. The standard approach to this too-many-parameters problem is the one advanced by Doan et al. (1984) which consists on using a small set of hyperparameters to characterize a suitable prior. We start characterizing the priors by means of proposing prior means and variances for the vector γ. The vector Ψ is assumed to be known:

Prior means of γ

The vector of parameters γ has k blocks; each block repre-

sents the parameters contained in each endogenous variable equation. There are kp parameters in each block, there one parameter counting the effect of the first own lag in each equation. The Litterman prior assumes that the variables are random walk, which means that only the parameters with own lags are equal to one and all the rest of the parameters are equal to zero. Here we consider non-zero constant parameters.

$$E(\gamma)=\begin{cases}1 & \text{for params. on own lags}\\ 0 & \text{for params. on lags of other vars. and other than first lags of own variable}\end{cases}$$

In short, we are going to group this information as $E(\gamma)=\widehat{\gamma}$,

Prior variance of γ

First we assume that the prior covariance among parameters is zero (for simplicity), then we will only refer to the diagonal elements of $V(\gamma)$. Here we have to gauge on the importance of the first own lags, those regarding to the rest of the variables and the rest of the lags.

Our uncertainty about first-own-lag parameters will be measured by the hyperparameter θ, this is true for all equations alike and provides a measure of how strong we believe on our random walk prior hypothesis. For second and higher order own lags, our uncertainty will shrink at a rate given by h^{λ}, where h is the lag order.

For parameters on other variables, θ is appropriately shrunk or expanded by virtue of a general weighting parameter ω_{ij}.

$$V(\gamma)\equiv\widehat{V}_{\gamma}=\begin{cases}\frac{\theta}{h^{\lambda}}\omega_{ii} & \text{for parameters on own lags}\\ \frac{\theta}{h^{\lambda}}\omega_{ij} & \text{for parameters on lags of variable } j\neq i\end{cases}$$

Given that θ controls all the endogenous parameter variances, IT is called *overall tightness*, on the other hand λ is called the *decay parameter*. The weighting parameters ω_{ij} are yet to be defined. Following Doan et al. (1984), we take into account the fact that variables in each equation might be measured in different scales. Hence, we compute error variances from running univariate autorregressions for each variable and put them on a diagonal matrix $\Omega=[\widehat{\sigma}_{ii}^{2}]$.

We also construct the matrix $W=[W_{ij}]$ which captures how much we shrink or expand the overall tightness for each lag. The diagonal elements W_{ii} are set to one, if we have more certainty about the prior regarding the parameter of variable j in equation i, then we can assume a lower value W_{ij}. The matrix of final weights $\left[\omega_{ij}\right]$ is obtained by computing $\left[\omega_{ij}\right]=\Omega W\Omega^{-1}$, which leads to:

$$\begin{bmatrix} \omega_{11} & \omega_{12} & \dots & \omega_{1k} \\ \omega_{21} & \omega_{22} & \dots & \omega_{2k} \\ \dots & \dots & \dots & \dots \\ \omega_{k1} & \omega_{k2} & \dots & \omega_{kk} \end{bmatrix} = \begin{bmatrix} 1 & W_{12}\left(\frac{\hat{\sigma}_1^2}{\hat{\sigma}_2^2}\right) & \dots & W_{1k}\left(\frac{\hat{\sigma}_1^2}{\hat{\sigma}_k^2}\right) \\ W_{21}\left(\frac{\hat{\sigma}_2^2}{\hat{\sigma}_1^2}\right) & 1 & \dots & W_{2k}\left(\frac{\hat{\sigma}_1^2}{\hat{\sigma}_k^2}\right) \\ \dots & \dots & \dots & \dots \\ W_{k1}\left(\frac{\hat{\sigma}_k^2}{\hat{\sigma}_1^2}\right) & W_{k2}\left(\frac{\hat{\sigma}_k^2}{\hat{\sigma}_2^2}\right) & \dots & 1 \end{bmatrix}$$

The prior information can be represented in terms of a set of stochastic restrictions:

[7] $$\hat{\gamma}_{k\kappa}=I_{k\kappa}\gamma_{k\kappa}+\varpi_{k\kappa}$$

Where ϖ is an *iid* perturbation with zero mean and variance defined by $\hat{V}_{\gamma}$. And $I_{k\kappa}$ is an identity matrix. This restriction [7] can be combined with the VAR model in [4] to generate a mixed estimation as proposed in Theil and Goldberger (1961). The mixed model is:

[8] $$\begin{bmatrix} Y \\ \hat{\gamma} \end{bmatrix} = \begin{bmatrix} \mathbf{Z} \\ I \end{bmatrix}\gamma+\begin{bmatrix} U \\ \varpi \end{bmatrix}$$

Where the weighted OLS estimation results in:

[9] $$\hat{\gamma}_{TG}=\left(V_{\hat{\gamma}}^{-1}+V_{\varpi}^{-1}\right)^{-1}\left[\left(\Psi_k^{-1}\otimes Z_{T.\kappa}^{'}\right)Y+V_{\varpi}^{-1}\hat{\gamma}\right]$$

Where $V_{\hat{\gamma}}$ is the variance of the OLS estimator found in equation [4]. This formula for this variance is given by:

$$V_{\hat{\gamma}}=\left(\Psi_k\otimes\left(Z_{T.\kappa}^{'}Z_{T.\kappa}\right)^{-1}\right)_{k\kappa.kk}$$

3.2 Deep priors

Equation [9] provides an estimator that weights both the OLS

and the prior parameters according to their covariance matrices. What is the extent of our prior variance? Do we have more information on the data generating process besides of what the data give US? How can we elicit values for the hyperparameters defining the overall tightness θ the decay parameter λ, and the weighting matrix W based on out-of-model information?

In fact we do have relevant information. First we know that in all the BVAR specifications there is an external block, variables whose dynamics are invariant to domestic conditions.[14] Second, we know that inflation targeting regime is the current monetary policy framework. We treat both pieces of information one by one.

Prior block exogeneity

The natural way of using the external block exogeneity is by assuming that the random walk prior for the external variables is stronger, namely the corresponding prior variance of our believe is smaller. Hence, we assume a specific form for the weighting matrix W, whose element will take three possible values:

$$W_{ij} = \begin{cases} 1 & \text{if } i = j \\ 0.5 & \text{if } i \neq j \text{ and } i \rightarrow \text{domestic variable} \\ 0 & \text{if } i > j \text{ and } i \rightarrow \text{external variable} \end{cases}$$

The nominal anchor

Next, we choose θ and λ using a simple criteria: If there exists a nominal anchor, which under inflation targeting is clearly defined as a specific inflation rate attained in a long-enough horizon in the future - then long-run forecasts of nominal variables should be compatible with IT.

If we assume the "neutral" interest rate during the last part of the sample period and expected to hold in the future is about $r_{ss} = 4\%$, then, given an inflation goal of $\pi_{ss} = 2.5\%$, the nominal interest rate ought to be $i_{ss} = 6.5\%$. Alternatively if we assume a steady state nominal world interest rate of 4.5% and a steady state risk premium of 2%, then the implied domestic equilibrium interest rate would be also close to $i_{ss} = 6.5$.

[14] See Cushman and Zha (1995).

So we try to choose the hyperparameters $\begin{bmatrix}\theta & \lambda\end{bmatrix}'$ in such a way to indirectly minimize a loss function of the form:

$$d = a_{\pi}\left(\widehat{\pi}_{ss} - 2.5\right)^2 + a_i\left(\widehat{i}_{ss} - 6.5\right)^2$$

Where $\widehat{\pi}_{ss}$ and $\widehat{i}_{ss}$ are long-horizon forecasts (6 to 7 years ahead).

TABLE 3: MSE (U-THEIL) OF BVAR FORECASTS-INFLATION CRITERION

	BVAR 1	*BVAR 2*	*BVAR 3*	*BVAR 4*
Overal Tightness *(θ)*	2.82	3.68	3.78	2.03
Decay *(λ)*	2.30	5.09	7.16	2.59
Long-run CPI inflation	1.79	1.92	2.38	2.30
Long-run interest rate	7.99	8.09	8.41	-1.84
Sample: December 2001 to August 2004				
		CPI Inflation		
3 months	0.71 (0.11)	0.90 (9.15)	0.78 (0.13)	1.35 (0.22)
6 months	1.05 (0.16)	1.53 (0.23)	1.32 (0.20	2.22 (0.33)
9 months	1.21 (0.16)	2.31 (0.31)	1.47 (0.20)	3.45 (0.46)
12 months	1.68 (0.20)	3.49 (0.42)	1.86 (0.22)	7.31 (0.88)
24 months	1.92 (0.16)	1.11 (0.09)	2.70 (0.23)	11.45 (0.97)
Average	*1.32 (0.16)*	*1.87 (0.24)*	*1.63 (0.19)*	*5.16 (0.57)*
		GDP Growth		
3 months	3.83 (0.19)	1.77 (0.09)	6.56 (0.33)	8.11 (0.40)
6 months	5.09 (0.26)	2.86 (0.15)	18.75 (0.96)	20.55 (1.05)
9 months	6.31 (0.33)	3.38 (0.18)	23.71 (1.23)	36.21 (1.88)
12 months	9.91 (0.54)	5.32 (0.29)	435.28 (2.49)	55.87 (3.07)
24 months	2.87 (0.18)	4.74 (0.30)	47.60 (2.98)	11.46 (0.72)
Average	*6.28 (0.33)*	*3.33 (0.18)*	*23.57 (1.25)*	*30.19 (1.60)*
Sample: December 2002 to August 2004				
		CPI Inflation		
3 months	0.77 (0.09)	0.82 (0.09)	0.77 (0.09)	0.87 (0.10)
6 months	1.35 (0.15)	1.20 (0.13)	1.09 (0.12)	1.66 (0.18)
9 months	1.34 (0.13)	1.43 (0.14)	1.17 (0.12)	1.57 (0.16)
12 months	1.36 (0.12)	1.24 (0.10)	0.81 (0.07)	1.76 (0.15)
Average	*1.21 (0.12)*	*1.17 (0.12)*	*0.96 (0.10)*	*1.46 (0.15)*
		GDP Growth		
3 months	3.73 (0.22)	1.52 (0.09	4.68 (0.28)	9.75 (0.58)
6 months	4.13 (0.26)	2.09 (0.13)	10.15 (0.65)	24.46 (1.56)
9 months	4.74 (0.31)	3.02 (0.20)	10.16 (0.66)	32.76 (2.14)
12 months	6.15 (0.39)	4.08 (0.26)	18.03 (1.13)	40.96 (2.56)
Average	*4.69 (0.29)*	*2.68 (0.17)*	*10.75 (0.68)*	*26.98 (1.71)*

The procedure results in different sets of hyperparameters according to each possible criterion. If $a_\pi = 1$ and $a_i = 0$ we only care about long-run inflation rates (inflation criterion) and the results are summarized in Table 3, there we compute 24 out of sample long-run forecasts for each BVAR and OLS-VAR associated and present the median values corresponding to the tightness and decay parameters. We observe that both tightness and decay values are sizeable, suggesting a mixed effect on the variance of the Litterman prior; a large variance due to a high value of the tightness parameter and a low variance due to a stronger decay to zero.

4. EMPIRICAL RESULTS

We use the median values for both tightness and decay parameters corresponding to each BVAR and possible criteria to perform the estimations and out-of-sample forecasts.

4.1 Procedure

To evaluate the out-of-sample forecast performance, we have to consider the timing of data releases. All variables are available at the end of the month being measured; however, domestic GDP is only available with two months delay.[15]

To use current information for data that is quickly released we resort to a conditional forecasting technique. This framework allows all data series that are not yet available for a given month to be forecasted "conditional" upon all the variables for which observations are available. Conditional forecasting consists in the following steps. First, we estimate the different BVARs at the end of a particular month using the data just available at that moment. For example, since domestic GDP is released with two months lag, the models are estimated without the last two observations of all variables. Second, data is completed with forecasts of domestic GDP for the last two months conditional on the observation of the rest of the variables within those two months.

The assessment of forecast accuracy of each BVAR specification

[15] For example, January GDP is released in March.

is obtained by recursively estimating and forecasting. The first vintage of data for estimation spans from August 1995 to November 2001 and the selected out-of-sample period for forecast validation goes from December 2001 to August 2004. We start the recursion by estimating the BVARs with data available until September 2001, two months before the first month of the out-of-sample period. Next, GDP observations of the last two months (October and November 2001) are completed by the above conditional forecasting procedure. Then forecast of variables starting at December 2001 are recorded and transformed as year-on-year changes, i.e. year-on-year inflation and year-on-year GDP growth. Finally, forecasts of transformed variables are compared to realized values at different horizons: three, six, nine, twelve and twenty-four months ahead and forecasts errors are stored. After that, next month observations are added to the data set for estimation and the above-detailed procedure is applied again. These steps are repeated until the out-of-sample period is completed.[16]

Pooling the results for each period yields a set of 33 three-months ahead forecasts, 30 six-months ahead forecasts, 27 nine-months ahead forecasts, 24 twelve-months ahead forecasts, and 12 twenty-four-months ahead forecasts. Given that, the forecasting performance for each model is measured by the difference between forecasts and actual outcomes over the out-of-sample period. The assessment of forecast accuracy is based on mean square error (MSE) and U-theil statistics.

During this exercise we note that overall forecast performance improves towards the end of the evaluation sample. To highlight this, we additionally calculate MSEs for a sample spanning from December 2002 to August 2004. This sub sample is not large enough to track the forecasting performance of models for twenty-four-months-ahead forecasts. However, we suspect that MSE and U-theil should have reduced for that horizon as well.

[16] These steps describe the procedures taken in actual forecast exercises, using just the amount of data available at the time the forecasts are made. However, IT is worth emphasizing that the BVAR estimation relies on fixed hyperparameters which we actually choose after the realization of data in our out-of-sample period, i.e. our objective choice of hyperparameters incorporates some notion of the evolution of the data thus far.

4.2 Results

After performing the out-of-sample forecasts we construct the MSE and U-theil values for each BVAR using the hyperparameters corresponding to the inflation only criterion (results for other criteria are shown in Tables 4 and 5).

TABLE 4: MSE (U-THEIL) OF BVAR FORECASTS-INFLATION AND INTEREST RATE JOINT CRITERION

	BVAR 1	*BVAR 2*	*BVAR 3*	*BVAR 4*
Overal Tightness (θ)	0.84	2.68	3.14	2.53
Decay (λ)	0.72	3.08	5.57	3.13
Long-run CPI inflation	1.54	1.39	2.24	2.62
Long-run interest rate	7.41	6.42	7.49	-2.92
Sample: December 2001 to August 2004				
		CPI Inflation		
3 months	0.73 (0.12)	0.93 (0.15)	0.86 (0.14)	1.44 (0.23)
6 months	1.08 (0.16)	1.96 (0.29)	1.70 (0.25)	2.31 (0.34)
9 months	1.22 (0.16)	2.88 (0.38)	2.25 (0.30)	3.65 (0.49)
12 months	1.69 (0.20)	4.37 (0.53)	3.31 (0.40)	7.84 (0.94)
24 months	1.94 (0.16)	0.74 (0.06)	1.11 (0.09)	13.28 (1.12)
Average	*1.33 (0.16)*	*2.18 (0.28)*	*1.85 (0.24)*	*5.70 (0.65)*
		GDP Growth		
3 months	3.75 (0.19)	1.65 (0.08)	4.49 (0.22)	8.05 (0.40)
6 months	4.95 (0.25)	2.60 (0.13)	11.43 (0.58)	20.92 (1.07)
9 months	5.86 (0.30)	3.71 (0.19)	14.06 (0.73)	32.27 (1.83)
12 months	9.07 (0.50)	6.14 (0.34)	25.96 (1.43)	54.49 (3.00)
24 months	2.42 (0.15)	6.64 (0.42)	27.77 (174)	17.05 (1.07)
Average	*5.91 (0.31)*	*3.53 (0.19)*	*13.99 (0.74)*	*29.68 (1.57)*
Sample: December 2002 to August 2004				
		CPI Inflation		
3 months	0.79 (0.09)	0.81 (0.09)	0.81 (0.09	0.84 (0.09)
6 months	1.37 (0.15)	1.34 (0.15)	1.31 (0.14)	1.58 (0.17)
9 months	1.33 (0.13)	1.48 (0.15)	1.54 (0.15)	1.50 (0.15)
12 months	1.36 (0.11)	1.35 (0.11)	1.36 (0.11)	1.87 (0.16)
Average	*1.21 (0.12)*	*1.24 (0.12)*	*1.25 (0.13)*	*1.45 (0.14)*
		GDP Growth		
3 months	3.68 (0.22)	1.22 (0.07)	4.39 (0.26)	9.71 (0.57)
6 months	4.09 (0.26)	0.75 (0.05)	8.58 (0.55)	25.25 (1.61)
9 months	4.55 (0.30)	0.91 (0.06)	6.78 (0.44)	32.63 (2.13)
12 months	5.79 (0.36)	1.31 (0.08)	9.27 (0.58)	39.21 (2.45)
Average	*4.53 (0.28)*	*1.05 (0.07*	*7.25 (0.46)*	*26.70 (1.69)*

TABLE 5: MSE (U-THEIL) OF BVAR FORECASTS-INTEREST RATE CRITERION

	BVAR 1	*BVAR 2*	*BVAR 3*	*BVAR 4*
Overal Tightness *(θ)*	0.71	0.06	0.71	2.76
Decay *(λ)*	1.23	2.27	4.85	3.32
Long-run CPI inflation	0.70	0.94	4.42	2.60
Long-run interest rate	7.31	6.50	4.91	-2.82
Sample: December 2001 to August 2004				
		CPI Inflation		
3 months	0.72 (0.12)	1.27 (0.21)	0.85 (0.14)	1.48 (0.24)
6 months	1.08 (0.16)	2.15 (0.32)	1.53 (0.23)	2.35 (0.35)
9 months	1.24 (0.17)	3.24 (0.43)	1.88 (0.25)	3.72 (0.50)
12 months	1.71 (0.21)	3.69 (0.44)	2.40 (0.29)	8.08 (0.97)
24 months	1.95 (0.17)	6.23 (0.53)	2.78 (0.24)	14.05 (1.19)
Average	*1.34 (0.16)*	*3.32 (0.39*	*1.89 (0.23)*	*5.94 (0.65)*
		GDP Growth		
3 months	3.63 (0.18)	7.40 (0.37)	3.45 (0.17)	8.03 (0.40)
6 months	4.68 (0.24)	22.59 (1.15)	5.50 (0.28)	21.04 (1.07)
9 months	5.48 (0.28)	42.47 (2.20)	5.06 (0.26)	34.73 (1.80)
12 months	8.54 (0.47)	67.29 (3.70)	9.08 (0.50)	53.58 (2.95)
24 months	2.36 (0.15)	29.89 (1.87)	5.98 (0.37)	18.68 (1.17)
Average	*5.58 (0.29)*	*34.94 (1.76)*	*5.77 (0.30)*	*29.35 (1.55)*
Sample: December 2002 to August 2004				
		CPI Inflation		
3 months	0.79 (0.09)	0.93 (0.10)	0.77 (0.09)	0.83 (0.09)
6 months	0.38 (0.15)	1.29 (0.14)	1.25 (0.14)	1.55 (0.17)
9 months	1.37 (0.14)	1.73 (0.17)	1.41 (0.14)	1.48 (0.15)
12 months	1.37 (0.12)	1.26 (0.11)	1.11 (0.09)	1.93 (0.16)
Average	*1.23 (0.12)*	*1.30 (0.13)*	*1.13 (0.11)*	*1.45 (0.14)*
		GDP Growth		
3 months	3.59 (0.21)	1.65 (0.10)	4.07 (0.24)	9.69 (0.57)
6 months	3.89 (0.25)	3.63 (0.23)	4.54 (0.29)	25.53 (1.63)
9 months	4.32 (0.28)	9.75 (0.64)	3.05 (0.20)	32.49 (2.12)
12 months	5.48 (0.34)	19.31 (1.21)	3.81 (0.24)	38.43 (2.41)
Average	*4.32 (0.27)*	*8.58 (0.54)*	*3.87 (0.24)*	*26.53 (1.68)*

Table 3 reports MSE and U-theil (in parenthesis) for different BVAR models in predicting CPI inflation and GDP growth, both measured on a year-on-year basis. The table also shows the hyperparameters (decay and overall tightness) and long-run forecasts (seven years ahead) for CPI inflation and domestic interest

rate of each model. As shown, all models but the BVAR 4 perform quite well for the inflation forecast in the first out-of-sample period (spanning from December 2001 to August 2004). Thus, the U-theil statistics corresponding to all horizons are consistently smaller than one for the three first models. Yet, the random walk model beats the BVAR 4 at the last two horizons. On average BVAR 1 has the most outstanding ability in forecasting inflation reporting the smallest U-theil statistics (0.16).

Regarding GDP growth, both BVAR 1 and BVAR 2 behave better than the random walk at all horizons. At the short horizon, within three-months and nine-months, MSE and U-theil values reveal that the latter model outperforms the former. However, at medium run horizons, twelve-months and twenty-four-months, the comparison between first and second models seems to be not quite defined. Overall, the BVAR 2 is marginally more accurate on average than BVAR 1. These results might suggest that there is a little gain of information in money aggregates for the GDP growth forecasting. On the other hand, both BVAR 3 and BVAR 4 were less accurate than the simple random walk for most horizons. As in the case of inflation forecast, evaluation of accuracy indicates that the BVAR 4 generates the worst-performing forecast.

By shortening the period of forecast evaluation from December 2004 to August 2004 (second panel of Table 3) we get similar results with respect to the GDP growth forecasts. Though, the results change at evaluating inflation forecast performance. Remarkably, all models outperform the naive random walk, getting U-theils statistics smaller than one. These results are consistent at both short and medium run horizons. On average the BVAR 3 outperforms marginally the rest of the models and has the best forecast performance at twelve-month horizons. Overall IT seems that by dropping the first observations of the out-of-sample period the forecast accuracy improves significantly.

Robustness Exercise: Changing the prior's criteria

A key issue in the estimation of Bayesian VARs is the choice of the hyperparameters. In order to factor the importance of the deep priors and the robustness of our results, we evaluate the forecast performance of the models under two alternative criteria regarding the choice of the hyperparameters. The first one is the

interest rate criterion in which we minimize $d = \left(\hat{i}_{ss} - 6.5\right)^2$ where $\hat{i}_{ss}$ is the simulated forecast at long horizon. We have assumed a steady state level of the nominal interest rate consistent with the inflation target in the order of 6.5%. The second is the *joint inflation and interest rate criterion* in which we minimize the following loss function $d = \left(\hat{\pi}_{ss} - 2.5\right)^2 + \left(\hat{i}_{ss} - 6.5\right)^2$. Tables 4 and 5 report the summary statistics for each criteria, respectively.

Interestingly, in terms of inflation forecast accuracy BVAR 1 outperforms the rest of the models across criteria within the first sample (December 2001 to August 2004). In the second sample (December 2002 to August 2004), BVAR 3 displays the best accurate forecast under inflation criterion. Although, across criteria the improvement of BVAR 3 is slightly superior to that of BVAR 1.

Regarding GDP growth, the BVAR 2 (which includes money aggregates) performs the best in the first sample by using both the inflation criterion and the joint inflation and interest rate criterion. Moreover, averaging MSE and U-theil at all horizons, the BVAR 2 has the best forecast accuracy in terms of GDP growth in the first sample by using the inflation criterion and in the second sample, under joint inflation and interest rate criterion. From the previous result, we infer that money might be helping at predicting GDP growth.

By ranking the results across criteria, we note that the interest rate criterion performs the worst no matter which sample is analyzed. Additionally, joint inflation and interest rate criterion only improves slightly some results. This gives more support towards the inflation criterion considered as the benchmark. Finally, overall the forecast accuracy improves considerably for inflation and GDP growth for the second sample period regardless the criteria and the model specification. This result might be associated with the significant change observed in the unconditional moments, in particular, sharp reduction in volatilities of the main macroeconomic variables which coincides with the adoption of the fully-fledged inflation targeting regime.

5. CONCLUDING REMARKS

From the beginning of 2002, the Central Bank of Peru has been implementing an inflation targeting regime. Thus, constructing

forecast of the main macroeconomic variables, in particular inflation, has become the core task of the policy makers. In this paper, we introduce a Bayesian forecast methodology suitable to evaluate forecast performance of inflation and GDP growth for the Peruvian economy.

Unlike other contributions, in our paper we have presented a rule that can be used to elicit Minnesota-type of priors in a Bayesian VAR context that can be more accurate to describe the dynamics of key macroeconomic variables for a country like Peru. The rule is based on choosing decay and tightness parameters that would induce the nominal anchor brought about by inflation targeting.

Our results show that the out-of-sample forecasts performed with the BVARs favour small BVAR specifications under various possible criteria.

Our Bayesian procedure can be improved remarkably in two fronts, first we need to compute confidence bands for forecasts and test the out-of-sample forecast densities rather than point forecasts as presented in this paper. Second, we need to go beyond the simple non-structural VARs presented in this paper and perform Bayesian structural VAR estimation and forecasting. Only when that final step is done we will be able to make our BVAR forecasting framework for ample use.

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The impact of Barbados' investment climate on its foreign direct investment inflows

1. INTRODUCTION

Foreign direct investment (*FDI*) is defined as the holding of ten percent or more of the voting stock of a non-resident enterprise. It is known to contribute to the better integration of developing countries into the world economy. Further, it transfers knowledge and diffusion of ideas and knowledge drives productivity growth.

Over the years, Barbados has made several attempts to attract additional as well as new *FDI* inflows to its shores. The process has been manifested through tackling the investment climate. The investment climate is composed of three broad sets of factors; *a)* macroeconomic conditions, that is fiscal, monetary investment and trade policies, *b)* institutions and governance, that is, legal and regulatory framework, and *c)* infrastructure, namely, availability and quality.

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Additional or new *FDI* into Barbados will yield the country foreign exchange and provide opportunities for additional employment. These opportunities allow Government to boost its revenue intake and use some of these proceeds to improve the country's infrastructure. It with these points in view that some attempt is being made to examine the impact of the investment climate on *FDI* into Barbados. This will be done using an impulse response function with annual data spanning from 1970 to 2004.

Section 2 will look at a short review of the literature on the above-mentioned topic. Section 3 will pay some specific attention to the investment climate and *FDI* as it relates to Barbados. Section 4 will deal with the impact of the investment climate on *FDI* inflows into Barbados and this will be followed by a conclusion.

2. SHORT LITERATURE REVIEW ON THE INVESTMENT CLIMATE AND *FDI*

The literature on the investment climate and *FDI* is one which should be of interest to many readers. Shiells (2003) examined capital inflows into the Commonwealth of Independent States (CIS) countries in view of disappointing levels of inward *FDI* and their investment climate. The author discovered that low *FDI* inflows, despite a strengthening macroeconomic performance, reflected a weak investment climate particularly owing to incomplete structural reforms. These reforms included burdensome tax systems, widespread corruption and extensive state intervention coupled with weak legal and regulatory frameworks.

Kinoshita and Campos (2003) studied factors accounting for the geographical patterns of *FDI* inflows among twenty-five transition economies using panel data from 1990 to 1998. One of the main conclusions was that *FDI* in the regions was attracted by an abundance of natural resources and low labour costs. However, the poor quality of the bureaucracy was found to be a deterrent to foreign investors as the increased transaction costs adversely affected the profitability of investment projects.

Research by Krkoska (2001) focused on the role of *FDI* in Central and Eastern Europe in financing gross fixed capital formation and its relation to other sources of financing, as well as to the variables describing the economic environment. Their findings

were, among other things, that improvements in the investment climate helping to attract higher *FDI* inflows will translate into higher gross capital formation, which, in turn, led to greater economic growth. This was more important in transition economies not endowed by natural resources and in transition countries with little state assets remaining to be privatised.

Some thought was given by the European Bank for Reconstruction and Development (1994) and also by Lankes and Venables (1996) into the motivation behind foreign firms seeking to become direct investors into the Eastern European, Baltic and CIS countries. They argued that direct investment into CIS countries was mainly resource-seeking while *FDI* into countries more advanced in the transition process was more often efficiency-seeking. In their opinion, a strategy of increasing labour productivity coupled with competitive labour cost, might assist in boosting the economic growth rates of the CIS countries and attract more efficiency-seeking *FDI*. In the case of CIS countries with large domestic markets, there may be potential for market-seeking *FDI* oriented toward production for sale in the domestic market in the future but this would seem to require significant improvement in the investment climate.

Once more, the role of the investment climate in determining *FDI* was highlighted in the paper by Garibaldi et al. (2001). This paper, which, used regression analysis in reaching its conclusions, suggested that the pattern of inward direct investment in transition economies could be well explained in terms of a set of economic fundamentals. These included variables that represented macroeconomic stability, the level of economic reforms, trade liberalization, natural resource endowments, the privatization method, direct barriers to inward direct investment and a measure of government bureaucracy, that reflected obstacles to investment and entrepreneurship that was closely related to corruption.

3. THE INVESTMENT CLIMATE AND *FDI* INFLOWS IN BARBADOS

In attempting to examine the investment climate in Barbados, we are guided by the Foreign Investment Advisory Service Report

(2004). The Report stated that foreign firms did not give equal weight to all aspects of a country's business environment. The major factors of interest to foreigners wishing to become investors in the Caribbean were infrastructure and labour issues and to a lesser extent, market access and issues relating to administrative procedures. Surprisingly, more than ten percent of the companies claimed that accessing local markets for either customers or inputs was of little interest to them. This Report compared Barbados with other Caribbean countries such as Dominican Republic, Grenada, Jamaica and Trinidad and Tobago with respect to policy and legal environment, *FDI* framework, market access, labour, administrative procedures, taxation and customs, infrastructure and quality of life.

As far as policy and legal framework were concerned, it was reported that Barbados was rated ahead of the other countries for its political and macroeconomic stability, the clarity and fairness of its laws and regulations, and its government's efficiency in providing public services. The same result obtained with its *FDI* framework. In this case, Barbados was perceived by investors to offer the best investment incentives and had more financing options available to foreign investors than the other countries. With market access, Barbados finished behind Jamaica and the Dominican Republic and was second to the Dominican Republic in the area of labour and administrative procedures. While investors did not find administrative procedures an overly important concern, the same could not be said for labour. The investors were pleased with the easy availability of all kinds of labour in the Dominican Republic in addition to the productivity of its workers, the smooth labour relations between management and labour as well as its flexible labour market regulations.

In the case of taxation and customs, these regimes were considered by international investors as a weakness in the overall investment climate. Barbados' rating in this regard was surpassed by all of the countries in the study with the exception of Grenada, partly the result of its high tax rates, but it placed among the first two countries for its infrastructure and quality of life, although the condition of its roads caused some concern to potential international investors.

As far as *FDI* inflows were concerned, between 1970 and 1985, *FDI* inflows accounted for the largest share of long-term capital

inflows, which averaged around $40 million (see Balance of Payments of Barbados). After 1985, although losing some of its dominance as a result of a pick-up in the remaining investment categories, *FDI's* contribution to the development of Barbados was still important. Indeed in 1987, it was discovered that *FDI* inflows were dominated by manufacturing and oil companies, which together accounted for seventy-eight percent of the total. Between 1977 and 1985, most foreign firms were in the sub-sectors producing electronic components and clothing. They represented seventy-one percent of direct investment in manufacturing [for further reading, see Codrington (1987)].

From 1986 to 2004, *FDI* inflows into Barbados averaged just over $30 million, reaching an all-time high of $116.5 million in 2003. This phenomenal performance was boosted primarily by the acquisition of a privately-held local company by a foreign entity, higher investment in branches and a rise in undistributed profits (see Campbell and Gill 2005). On the contrary, the decline in of *FDI* inflows of $24.2 million in 2004 appeared to be the first occasion in Barbados' history that a contraction in this category had occurred. This resulted from a decrease in investment in branches and subsidiaries by parent companies (see Balance of Payments of Barbados).

The UNCTAD *FDI*/Transnational Corporation's (TNC) World Investment Report (2003) stated between 1990 and 2002, Canada was Barbados' highest foreign direct investor (investing some $100 million during the above-mentioned period or $8.3 million annually), followed by the USA. Other foreign direct investors were China, Colombia, Germany, Malaysia and Republic of Korea. The United Kingdom was an important foreign direct investor in Barbados up until 1994 when such investment ceased.

4. MODEL SPECIFICATION, METHODOLOGY AND DATA

a) Model specification

A model of *FDI* can be expressed as follows:

$$FDI = f(\underset{+}{IC}) \tag{1}$$

where *FDI* represents real foreign direct investment inflows and

IC is the explanatory variable, namely investment climate. *FDI* is expressed in real terms by adjusting this variable by gross domestic product (GDP). The positive sign under the *IC* variable suggests that as the investment climate in Barbados improves, it is likely to become more attractive for foreign direct investors to invest in Barbados and *FDI* inflows are anticipated to expand.

b) Methodology and data

A cointegration approach is being used for the estimation of the model. This involves *a)* testing for cointegration, *b)* testing over and exact identifying restrictions, and *c)* using generalized impulse response analysis. This procedure is based on the maximum likelihood estimation of a vector autoregressive (VAR) system. Consider the following VAR of order p in the $(n+1)$- vector of variables z_t:

$$z_t = a + c_t + \sum_{i=1}^{p} \phi_i z_{t-1} + \xi_t, t = 1,2,3,... \quad (2)$$

where a and c are $(n+1)$ –vector of intercepts and trend coefficients and ϕ_i, $i = 1,\ldots p$, are $(n\text{-}1)$ x $(n+1)$ matrices of coefficients. z_t is partition as $z_t = [E_t X_t']$ where E_t represents the dependent variable, *FDI* and X_t is an n-vector of forcing variables, $t = 1, 2, \ldots$ ξ_t is a vector of Gaussian errors. The very important assumption made here is that the roots of:

$$\left| I_{n+1} - \sum_{i=1}^{p} + \Phi_i z^i \right| = 0$$

either lie outside the circle unit $|z| = 1$ or satisfy the condition $z = 1$. Such an assumption allows the elements of z_t to be of order zero, one or cointegrated. By the process of re-parameterizing, the unrestricted vector error correction (VEC) form of (2) is given by:

$$\Delta z_t = a + c_t + \Pi z_{t-1} + \sum_{i=1}^{p=1} \Gamma_i' \Delta z_{t-1} + \xi_t, \quad t = 1,2,... \quad (3)$$

where:

$$\Pi = -(I_{n+1} - \sum_{i=1}^{p} \Phi i) \text{ and } \Gamma' = \sum_{j=t+1}^{p} \Phi j, \quad i = 1,...,p-1$$

are the $(n+1)$ x $(n+1)$ matrices of long-run multipliers and short-run dynamics coefficients respectively.

Since the matrix Π controls the cointegration properties, the rank (r) of Π determines the number of cointegrating vectors in the system. There are three cases:

- Case 1: Π has full rank and any linear combination of z_{t-1} is stationary. This allows us to estimate our normal VAR in levels.
- Case 2: Π has reduced rank, which implies that there are some linear combinations of z_t that are stationary, so that z_t is cointegrated. VAR in levels is consistent but inefficient (Koop et al., 1996) and a VEC must be estimated.
- Case 3: Π has zero rank, so that no linear combinations of z_{t-1} are stationary. Δz_t is stationary with no integration. In this case, a normal VAR in first differences can be estimated.

In case 2, the matrix Π can be expressed as $\Pi = \alpha\beta'$ where α and β are both $(k+1)$ x (r) matrices of full column rank; β is the matrix of cointegrating vectors and α is the matrix of "weighting elements".

The test statistics for determining the cointegrating rank, based on the hypothesis that the rank is at most $(k\text{-}r)$ against the alternative that the rank is $(k\text{-}r\text{-}1)$, are the trace statistics given by:

$$Q_t = -T \sum_{i=T-1}^{k} \log(1-\lambda_i)$$

and the maximum eigenvalue statistic given by $Q_{\max} = -T \log (1-\lambda_{T-1}) = Q_t - Q_{t-1}$ where λ_i is the largest eigenvalue. The critical values in both cases can be found in Osterwald-Lenum (1992).

Once the model has been estimated, its dynamism is investigated with the use of the impulse response (IR) function to measure the time profile of the effect of shocks on future states of the system. An IR function traces the effect of a one standard deviation shock to one of the innovations on current and future values of the endogenous variables. The responses which occur in the initial periods after the shock will explain the behaviour of the system in the short run, whereas the responses which occur in later periods will provide insights about the long run effects.

Two different IR functions can be computed, namely the standard Orthoganalised IR function adopted by Sims (1980) and the

Generalised IR function by Koop et al. (1996) and Pesaran and Shin (1996). The Orthogonalised IR functions are not unique and depend on the particular ordering of the VAR. This is so because the orthogonalised IR functions are obtained by first employing a Cholesky decomposition of the covariance matrix of the shocks ξ_t in equation (2), which creates a problem because the Cholesky decomposition is non-unique. Generalised IR functions, by construction, circumvent the problem of dependence of the orthogonalised IR functions on the ordering of the VAR. Emphasis is therefore being placed on the Generalised IR function in this study.

The study uses annual data from the Balance of Payments of Barbados for the period 1970-2004. In an attempt to arrive at a proxy for the independent variable, namely, investment climate, this writer is guided by UNCTAD (1993) which suggests that the share of investment in GDP may provide an indication of the investment climate in a country. Supporting evidence in this regard is provided by Kudrie (1995). The econometric package EVIEWS 5 has been used to perform the estimations.

c) Results

Since the main justification for embarking on cointegration analysis is to study the long-run co-movement of a group of variables, it is necessary to investigate the order of integration of the individual series. Both variables were found to be integrated of the first order, sometimes expressed as $I(1)$. The results, with the use of the Augmented Dickey-Fuller study (1979) looked at the mean changing root test. The results are shown in Table 1. We turn our attention to selecting the order of the VAR, ρ, and have opted to restrict the order of the VAR to two, taking into consideration the short data series. In this situation, we must ensure that

TABLE 1: AUGMENTED DICKEY-FULLER (ADF) UNIT ROOT TEST

	Intercept and Trend (Level)	*95% Critical Value*	*Intercept and Trend (First Difference)*	*95% Critical Value*	*Lag Length*
FDI	-2.54	-2.96	-7.46	-2.96	0
IC	-2.47	-2.96	-4.49	-2.96	0

there are no problems of serial correlation. The Akaike Information Criteria (AIC) and the Schwarz Bayesian Criteria (SBC) each select the order of one with an intercept and trend. Further, an examination of the residuals of the error correction model for serial correlation provides a clean bill of health for the order of one. As a result, this order has been selected.

Let us now direct our attention to Table 2, which provides the results for the test for cointegration based on the trace eigenvalue statistics. These strongly reject the null hypothesis that there exists no cointegration relationships between the variables (namely that r equals zero) but indicate that there is one cointegrating relationship between them. The maximum eigenvalue statistics were also calculated but not reported since they yielded the same conclusions.

TABLE 2: TESTS FOR NUMBER OF COINTEGRATING VECTORS (TRACE STATISTICS)

Null	*Alternative*	*Eigenvalue*	*Statistic*	*95%critical value*
$r = 0$	$r = 1$	0.727034	41.28072	12.3290
$r < 1$	$r = 2$	0.032681	1.030034	4.129906

Maximum likelihood estimates of the cointegrating vector are obtained by imposing Johansen Exactly Identifying Restrictions. The main interest in these estimates is that the explanatory variable is statistically significant. It should be noted that the independent variable, investment climate, is a forcing variable (or weakly exogenous), since, when the system is in diseqilibrium, equilibrium will then be achieved by the response of this variable.

TABLE 3: LONG-RUN COINTEGRATING EQUATION (NORMALISED ON *FDI*)

FDI	1.00000
IC	0.03103 (0.0088)
INTERCEPT	6.32155

NOTE: Standard error is given in parenthesis.

Table 3 shows the results of the long-run cointegrating equation normalized on *FDI*, namely that there is a positive relationship between *FDI* and the independent variable, investment climate

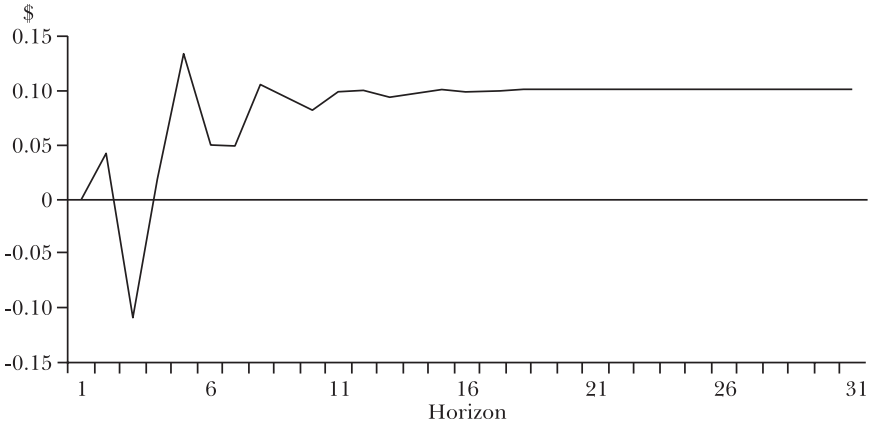
TABLE 4: SPEED OF ADUSTMENT FROM DISEQUILIBRIUM

FDI	-0.8413 (0.1191)
IC	-0.5502 (0.4020)

NOTE: Standard errors are given in parenthesis.

for Barbados. Further, the investment climate variable has been found to be highly significant as the standard error value indicates. In Table 4, the error correction coefficient is negative and significant as required and its value of 0.8413 suggests that any disequilibria experienced by this model will be corrected by approximately 84.1 percent annually for a period of just over one year.

FIGURE 1. RESPONSE OF *FDI* INFLOWS TO INVESTMENT CLIMATE ($mil)



We now direct our attention to the impulse response function shown by Figure 1. This looks at how *FDI* inflows respond to a shock in the investment climate variable. A positive standard error shock to the investment climate variable will cause *FDI* inflows to expand above the original equilibrium level by just under $5 million in the first two years. However, in the third year, *FDI* will contract by around $13 million. This may appear surprising but such a development can occur depending on which components of the investment climate are dominant at the time.

You may recall that the Foreign Investment Advisory Service Report (2004) highlighted that in the Caribbean, a significant

amount of foreign investors placed a high priority on infrastructure and labour issues while some of them placed moderate and in some cases, no importance on access to local markets when making investment decisions. This means that if, for example, during the third year, Barbados' investment climate improved as a result of easier access to local markets at the expense of labour relations, it is likely that foreign investors may consider alternative destinations for their investment rather than Barbados. *FDI* inflows into Barbados will therefore deteriorate. In the fourth and fifth years, Figure 1 shows a turnaround in *FDI* transactions, with *FDI* inflows rising by between $2 million and $14 million. In the sixth year, *FDI* inflows slowed and remained flat in the seventh year. In the period that followed, inward *FDI* transactions picked up to grow by $10 million. There was a slight fall-off in inward *FDI* to approximately $8.5 million in the next four years but the expansion was still above original equilibrium. A new equilibrium occurs around the twelfth year, which shows *FDI* inflows increasing by $10 million. This means that any positive shock to Barbados' investment climate will cause *FDI* inflows to grow by $10 million above the original equilibrium, which is desirous for Barbados.

What then do the results of the impulse response function tell us? We find that an improvement in the investment climate in Barbados will yield higher *FDI* inflows for that country over the long term. This means that Barbados should ensure that it maintains its lead over its Caribbean countries in those components of the investment climate which foreign investors consider important. However, it should also seek to improve its rating in those components which are presently dominated by its Caribbean neighbours since it is possible that changes in the preferences of foreign investors may occur over time.

In this regard, Government has undertaken an extensive road rehabilitation programme, partly with regard to the staging of the 2007 International Cricket Council (ICC) World Cup in mind and liberalized telecommunications services. It recently upgraded the air and sea ports in order to meet international requirements especially in the area of security, to accommodate increased travel to Barbados as well as to reduce delays experienced both at the immigration and customs areas. Indeed, mention was made in the Economic and Financial Policies of the Government of Bar-

bados (2004) of plans to modernize the Customs Department via the use of information technology. Despite occasional tensions between management and staff, the Social Partnership (a partnership between Government, the private sector and the Trade Unions), which was established around 1993 continues to survive with good results.

As far as taxation is concerned, within the last four years, Government has reduced the marginal income tax rate on outstanding taxable income and increased personal income tax allowances. The rate of taxes on corporations has also been reduced. These moves have been an attempt by the Government to make Barbados competitive with its CARICOM neighbours, with the CARICOM Single Market and Economy uppermost in its mind.

The foreign reserves of Barbados have been under pressure over the last three years and additional *FDI* inflows can go a long way in addressing this problem. This will encourage the Government of Barbados to maintain a low interest rate regime so that economic activity may be boosted. With an expansion in economic activity, the revenue intake of Government is likely to expand, allowing it the opportunity to increase its current and capital outlays and improving the country's quality of life.

CONCLUSION

The purpose of this paper was to examine the impact of Barbados' investment climate on its *FDI* inflows. As far as the investment climate was concerned, when compared to Dominican Republic, Grenada, Jamaica and Trinidad and Tobago, Barbados was rated ahead of these countries with its policy and legal framework, *FDI* framework and market access and infrastructure. It was virtually on par with Jamaica and Grenada with regard to quality of life. On the contrary, it was somewhat behind most of the abovementioned countries in the area of taxation and customs and some concern was expressed with its roads. It should be noted, however, that Barbados is presently undertaking an extensive road rehabilitation programme mainly with a view to staging the 2007 ICC Cricket World Cup. In addition, it has upgraded its air and sea ports to meet international security requirements, han-

dled additional travellers and addressed shortcomings at the customs and immigration departments. Further, it has maintained a successful Social Partnership, liberalised its telecommunications services, and taken steps to gradually reduce the rates on income and corporation taxes with a view to increasing its competitiveness with its CARICOM countries.

Most of Barbados' inward *FDI* has come from Canada and the USA, but over the years, other countries have made valuable contributions in this area. Between 1970 and 2002, *FDI* inflows to Barbados have averaged just over $30 million but in 2003, a significant increase of over $100 million occurred, mainly on account of the acquisition of a local private company by a non-resident enterprise. In 2004, *FDI* inflows declined for the first time in Barbados' history.

When the impulse function was used to look at the relationship between *FDI* and the investment climate, the result showed that there was a positive relationship between the two variables. Further this function showed that when a standard error shock was applied to the investment climate variable over a thirty-year period, *FDI* would reach a new equilibrium in the twelfth year. During this year, *FDI* would rise by some $10 million above the original equilibrium, which is desirable for reasons such as economic growth promotion and foreign exchange accumulation.

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Isabelle Strauss-Kahn

Secrecy in foreign exchange interventions: the point of view of a practitioner in a European context

INTRODUCTION

The demand for transparency and accountability from central banks has become increasingly pressing. While monetary policy actions are in general well-publicized and clearly conveyed to the market, there is still a debate as far as foreign exchange intervention is concerned. This can be explained by the fact that the central bank is the only institution that sets interest rates, in a discretionary way, but not the only actor that can influence or fix the level of the exchange rate. This paper reviews the experience of foreign exchange intervention in the context of the European Monetary System (EMS), which lasted from 1979 to 1998, and the Exchange Rate Mechanism II (ERM II), which followed in 1999. In both systems, intervention plays a central role and is actively used. While secrecy was a rule in the EMS, transparency is much more prevalent in ERM II. The paper seeks to assess what has been

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called "the secrecy puzzle" taking the practitioner's point of view. Section 1 compares the characteristics and the functioning of the EMS and ERM II. Section 2 discusses the issue of the effectiveness of secret intervention versus overt intervention. Section 3 takes into account the microstructure of the foreign exchange market.

1. COMPARING THE FUNCTIONING OF THE EMS AND ERM II

We start by highlighting the characteristics of the two systems and we follow by describing how they work.

1.1 Characteristics of the two systems

The table below gives an overview of the main characteristics of the EMS and ERM II.

	EMS (1979 to 1999)	*ERM II (from 1999 onwards)*
Central parity	Against the ECU + a multiple grid of bilateral parities	Against the euro only
Fluctuation band	+/- 2.25% and +/- 15% from 2 August 1993	+/- 15% but either unilateral commitment for a narrower band or mutually agreed narrower band if it enhances convergence (case of DKK with +/- 2.25%)
Warning mechanism	Divergence indicator at 75% of the band against the ECU, implying intra marginal intervention and/or corrective macro economic measures	Nothing
Intervention	- Intra-marginal and unilateral; - At the margin: unlimited and automatic	Intra marginal unilaterally; coordinated intra marginal, with the ECB and the NCBs also possible; at the margin: unlimited and automatic but ECB and NCBs may suspend intervention if it conflicts with the primary objective
Financing mechanism	Very Short Term Facility (VSTF) + inter central banks borrowing/lending facility	VSTF also
Possibility of realignments	Yes	Yes

The two systems can be seen as multilateral target zones, with a central parity that is a key and highly psychological indicator for the monetary authorities and also the market. ERM II appears to be more straightforward, with parities against the euro only, without bilateral parities between the currencies of the participants, which have a clear exit, the adoption of the euro. In fact the situation is quite different. Before 1999, the EMS was one of the means of achieving monetary union, whereas the members of ERM II wish to join an existing monetary union with a single currency.

Intervention plays a central role in both systems.

The EMS was designed as a symmetrical system since there were symmetrical obligations for weak as well as strong currency countries. Experience shows, nevertheless, that this was not really the case since the DEM was the anchor currency in the system and the burden of adjustment mostly lay on the other currencies, with a lot of intra marginal intervention and several realignments.

ERM II is a dual system, for it is a tool to achieve stability and foster convergence. It also serves as one of several criteria of convergence against which the country will be judged as to whether or not it may join the euro area. This clearly requires accession countries to foster sound fiscal discipline, sound supervision and regulation of financial markets, credible macro economic policies and early recognition of imbalances in fundamentals. The system appears to be asymmetric and this is a direct lesson from the functioning of the EMS. At the same time, ERM II has some advantages over the EMS, namely: shared responsibility for the functioning of the system, mutual close and continuous surveillance of participants and markets, principle of automatic intervention (even though the ECB may decide to stop such intervention), clear definition of the obligations of each party, clear exit (the adoption of the euro), large fluctuation bands and possibility of realignments to accommodate the process of real appreciation and structural adjustments. ERM II should therefore enhance stability and flexibility and limit speculative crises.

1.2 A few reminders of the functioning of the two systems

As regards the EMS, we will focus on the French franc since it

experienced several crises and realignments. As shown in the table in Annex I, the French franc came under pressure several times, which triggered numerous adjustments of the central parity.[1] In the 1992-1993 crisis, the French franc was heavily attacked but was not devalued as were the ESP, PTE and IEP. ITL and GBP suspended their participation in the EMS, ITL reentering the EMS on 24 November 1996. The fluctuation bands were enlarged to +/- 15% on 2 August 1993.

Throughout this period, the Banque de France intervened often, and sometimes quite heavily, intra marginally and at the limit, and always secretly. The interventions were both "against the wind" and "with the wind", and in general sterilized. The pattern of intervention nevertheless changed after 1987 due to the Basel-Nyborg agreement.

Before 1987, the central parity was often defended using USD intervention, and flexibility around the central parity was tightly limited thanks to intra marginal intervention, which represented 80% of the total intervention in the 1979 to 1987 period. Changes in the USD/DEM rate could also create tensions in the EMS, especially when the US currency was weakening. Most of the realignments occurred after a fall in the dollar. In fact, when investors shifted out of the USD they more than proportionally turned to the DEM since there were no capital controls in Germany. This was called the "leading currency" effect, which was not symmetrical and thus not observed when the dollar was appreciating.

With the Basel-Nyborg agreement, EMS members undertook to lay emphasis on the use of interest rate differentials to defend the stability of the EMS grid, to use permitted fluctuation margins flexibility in order to deter speculation and avoid prolonged bouts of intra marginal intervention.

After this agreement, the French monetary authorities agreed to let the FRF fluctuate more freely within the band, but with some asymmetry: tolerance to go to the margin was greater with an appreciation of the currency than with depreciation. Intra

[1] 4 October 1981 - 3% devaluation against DEM and NLG, 12 January 1982 – 5.75% devaluation against DEM and NLG, 21 March 1983 – 2.5% devaluation against the ECU, 6 April 1986 – 3% devaluation against the ECU, 12 January 1987 – 3% devaluation against the DEM and NLG and - 2% against BEF, 13 September 1992 – 3.5% revaluation against the ECU (corresponding in fact to a 7% devaluation of ITL against all EMS currencies).

marginal intervention operations nevertheless remained important, as they were in the 1992-1993 crisis, but were mainly conducted against the DEM and no longer the USD. This reflected a shift in macro economic policy, with the beginning of the "strong French franc" policy of the early 1990s, built on a clear anchor on German monetary policy.

As regards the ERM II, at present, there is the Danish Krona with a clear peg to the euro and a mutually agreed +/- 2.25% fluctuation margin. Estonia, Lithuania, Slovenia, Cyprus, Latvia, Malta (which joined ERM II on 2 May 2005) and Slovakia (which joined on 28 November 2005) have the standard deviation of +/- 15%. Estonia, Lithuania (which have currency board exchange rate regimes) and Malta (conventional peg) have unilateral commitments to maintain their respective currencies at the central parity, while Latvia has a +/-1% unilateral intervention band. Apart from Denmark, the history is particularly short and all these economies are quite small. Till now, exchange rates developments have been quite smooth (see Annex II), with the use of unilateral intra marginal intervention, the frequency of which varies quite considerably (more frequent naturally for the currency boards and the currency peg). On 1 October 2004 the "Immediate Notification Procedure" was introduced, obliging all non-euro NCBs to immediately notify the ECB of all non-compulsory euro interventions in excess of EUR 200 million and for each multiple of EUR 200 million. In terms of intervention techniques, a specific feature should be highlighted, for Slovenia: the central bank operates a standing forex swaps facility to exchange foreign currencies for SIT for a maturity of 7 days. These operations substitute temporary purchases of euro for permanent purchases of euro, but they are not aimed at influencing the exchange rate.

The pattern of intervention operations can be described as follows:

— Denmark: infrequent intervention + interest rate changes

— Estonia and Lithuania: currency boards, almost daily intervention but no monetary policy changes

— Slovenia: swap window, almost no spot intervention

— Cyprus: frequent intervention + interest rate changes

— Malta: peg regime, no frequent intervention + interest rate changes

— Latvia: no frequent intervention

— Slovakia: no frequent intervention

Most of these central banks follow a transparent policy, especially Denmark which systematically announces the timing and size of its intervention operations.

It will be interesting to follow the behavior of the as yet non-participating countries (Hungary, Poland and Czech Republic), which are bigger economies, with larger capital markets.

On the whole, it is quite difficult to compare the histories of the EMS and ERM II since that of the latter is short, and Denmark has never been prone to sudden exchange rate swings due to its long-term strong and credible economic policy anchored on the euro area. The only common feature is the use of intervention as a central tool. The main issue is the effectiveness of these intervention operations.

2. IS SECRET INTERVENTION MORE EFFECTIVE THAN OVERT INTERVENTION?

After reviewing the literature on secrecy in interventions, we will try to compare the academic results with the experience gained at the Banque de France.

2.1 Review of the literature

There is a great deal of academic and empirical literature on the effectiveness of foreign exchange intervention and the "secrecy puzzle" (IMF paper, Sitx, Barnett and Ozerturk, Sarno and Taylor, Bhattacharya and Weller, King, etc.).

We focus only on the case of sterilized intervention since this was predominantly the case in the EMS and is also so in ERM II. Sterilized intervention may influence the exchange rate through two channels:

— *The portfolio balance channel* assumes that investors change their holdings of domestic and foreign assets in response to sterilized intervention. Sterilized intervention neutralizes the impact on

credit conditions but changes the composition of agents' portfolios due to the purchase or sale of domestic assets during sterilization. In theory, the spot exchange rate should change over time as investors rebalance the mix of domestic and foreign assets in their portfolios. This channel works if foreign and domestic assets are imperfect substitutes, which is not true for actively traded floating currency. This portfolio balance channel has also been contested on the grounds that the scale of intervention has declined compared to the size of foreign exchange markets (BIS, 2001). While less support has been given to the importance of this channel in the recent years, some studies remain in favor of this explanation for intervention effectiveness:

  - Ghosh (1992) provides some evidence for a weak but statistically significant portfolio influence on the USD/DEM exchange rate using data from 1980 to 1988;
  - Dominguez and Frankel (1993b) found strong support of the portfolio balance channel and therefore effectiveness of intervention, especially coordinated operations.

- *The signaling channel* relies on asymmetric information and argues that sterilized intervention provides new information to the market by signaling a change in policy. Because the exchange rate is a forward-looking variable, a shift in expectations concerning future movements in variables affecting the fundamentals will now affect the exchange rate (Sarno and Taylor 2001). The channel works because the central bank is supposed to have information that is superior to that of other market participants. Furthermore, since intervention is costly if unsuccessful, the central bank should be willing to clearly explain its intervention. However to be credible and time consistent, it must follow its signals with actions. Several empirical studies have shown the effectiveness of intervention through the signaling channel. In particular, Dominguez and Frankel (1993a) show strong statistical evidence supportive of the effectiveness of sterilized intervention through both the portfolio balance and signaling channels, using USD/DEM data and under the assumption of constant interest rates.
- *The "secrecy puzzle"* relates to the fact that most interventions

were carried out secretly in the 1980s and 1990s, which is in contradiction with the signaling effect. Several reasons have been given for this "secrecy puzzle":

— The central bank may wish to minimize the effects of an unwanted intervention decided by other authorities such as the Ministry of Finance. In fact an unsuccessful intervention may, in such cases, damage the reputation and credibility of the central bank.

— Public announcement might exacerbate risk and volatility in the market, as market participants react to new information. If the objective is to dampen volatility, the announcement may be counterproductive.

— Vitale (1999) shows that, by concealing its target, the central bank may more easily "fool" the market, especially if the target is inconsistent with the fundamentals. A public announcement would not be credible and set up a one way bet against the central bank.

— Furthermore a monetary authority may wish to intervene even when action is inconsistent with the fundamentals of the foreign currency. If the action were known, financial actors would foresee that intervention is unsustainable, leading to the central bank's action being discounted by the market.

Empirical results differ on the subject.

Dominguez and Frankel (1993c) argue that official announcements and reported intervention operations significantly affect exchange rate expectations and the effectiveness of intervention.

H. Sitx (2002), using data on French and Spanish intervention in the 1992-1993 crisis, shows that central banks in the EMS used secret intervention in order to avoid speculative attacks. In particular, if market participants are aware of intervention operations, the more the central banks intervene to defend the peg, the higher the transfers to speculators when the authorities eventually give up the peg, and hence the higher the incentive to attack the currency. He also shows that public intervention seems to be associated with an increase in the level and volatility of expected exchange rate realignments.

R.C. Barnett and S. Ozeturk (2003) show that when the market is

too uncertain, the central bank may improve the price impact and hence the effectiveness of intervention by selectively disclosing its target to the other informed trader.[2] They also argue that the time of disclosure depends on the strategy. When the central bank is "leaning against the wind", selective disclosure achieves better targeting if there is enough uncertainty about the central bank's target. But when it "leans with the wind", it is never better-off by selectively disclosing the target and complete secrecy is better.

Bhattacharya and Weller (1999) consider that intervention is costly for the central bank. Thus there is a critical value above which the central bank will choose to reveal its target, if it is allowed to do this. However the central bank will never find it advantageous to reveal the scale of its intervention activity because the market would learn too much and the central bank would lose all ability to influence the market.

Hung (1997) argues, for his part, that the most effective strategy for breaking a trend is to intervene secretly and "with the wind" (the so-called "pushing on an open door" strategy).

Evans and Lyons (2001) argue that secret intervention can have significant effects because order flows can have a significant and persistent impact on the level of the exchange rate, through the portfolio balance channel. If the central bank can disguise its intervention as customer flows, intervention may have a longer term impact.

More recently, *Beine and Janssen (2004)* have attempted to assess the economic desirability of transparency in central banks' intervention on the foreign exchange market by focusing on statements given on the day and after the day of intervention and to assess the efficiency of actual and perceived intervention. They conclude that intervention operations accompanied by speeches have a more virtuous impact on exchange rate because they alleviate uncertainty with respect to the occurrence of the foreign exchange operations.

Lastly, *Cornaud and Heinemann (2005)* also studied the impact of announcements, using a currency attack model with multiple

[2] The authors introduce in their model a second informed trader such as another central bank that trades for speculative or wealth preservation reasons only.

public signals. They conclude that central banks should benefit at least from two tools:

— if used appropriately, the number and precision of announcements can be effective at stabilizing the economy in situations where it might be prone to self-fulfilling crises;

— otherwise, with a sufficiently large number of public signals the probability that an economy is hit by a crisis due to self-fulfilling beliefs can be reduced to almost zero provided that these signals are not too precise.

As a sort of summary, *King (2003)* presents a table crossing the objectives of the monetary authorities (political and tactical) with the strategy of intervention that has to be adopted.

	Objectives	*Strategy of intervention*
Policy objectives	Targeting a policy level for the exchange rate under a floating exchange rate regime	• Transparent, credible, time consistent announcement and coordinates
	Signaling a change in future policy	• Support by macro-economic policy "against the wind" (increase of the signaling effect)
Tactical objectives	Reducing volatility of the exchange rate or resisting a short term trend	• Secret and "with the wind"
	Reversing a long term trend	• + large size
	Discouraging speculation against the currency	• + timed for maximum impact

Therefore empirical studies vary in their appreciation of the impact of secrecy on the intervention's effectiveness, but this appraisal is contradictory to what central banks seem to think.

2.2 Survey of central banks

Neely (Fed Reserve of Saint Louis – 2001) conducted a survey on practices of central bank intervention. He gathered opinions of 22 central banks from emerging and developed countries among which seven were central banks of the euro area or ERM II, BE, DN, DE, FR, IE, IT, ES (see Annex III). Some striking results emerge:

— On the strategy followed, 89.5% report resisting short-term trends, and 66.7% returning to the exchange rate fundamentals.

— 95% of the central banks surveyed adapt the size of the intervention operations to the reaction of initial trades in the market.

— On secrecy, there is no full consensus, but stylized facts: 76.5% say that they intervene sometimes or always secretly to maximize market impact (effectiveness), 57% to minimize market impact (volatility). But no central bank cites portfolio adjustment as a reason for secret intervention.

— In terms of horizon, most central banks say that intervention has an impact on the exchange rate: 38% over a few minutes; 22.2% over a few hours, 27.8% over a few days and only 11.1% over more than a few days.

2.3 A practitioner's point of view

From an EMS perspective, we focus on the Banque de France experience.

Most of the Banque de France's intervention operations were secret and also intra-marginal even if intervention at the limit occurred several times and for very large sizes.

The basic reasoning was the following:

> Within the framework of the EMS, full use of the 2.25% fluctuation margin may, if the intervention points are reached, lead market participants to think that realignment is imminent. It is therefore not surprising that most intervention is intra marginal. Action of this kind does not entail any exchange rate objective within a fluctuation margin which is in any case narrow. In certain circumstances, however, it may be desirable, at least temporarily, not to go beyond the exchange rate threshold. On other occasions and particularly in times of acute crisis, it may, conversely, be useful to move swiftly to the exchange rate level at which the speculation in the market on a realignment would no longer be profitable.

We consider two periods in the history of Banque de France intervention, the 1980s and the 1990s.

The FRF was devalued six times in the 1980s. At that time, the Bank generally kept the exchange rate close to its central parity, while it intervened intra marginally. But when it was clear that

the level of the exchange rate was unsustainable and inconsistent with the fundamentals, the Bank let the exchange rate drift to the limit very rapidly and the adjustment of the parity was requested at the European level. This behavior was typical in particular for the realignments which occurred in the early 1980s. The crises that the FRF underwent, relate, in my view, to the first generation model of currency crises (Krugman 1979). According to that model, ongoing fiscal deficits financed by borrowing from the central bank lead to losses in reserves, which ultimately force the authorities to abandon the fixed parity. Forward-looking investors, anticipating the collapse and resulting exchange rate movements have an incentive to attack the central bank.

Indeed, in the beginning of the 1980s, expansive fiscal policies triggered high inflation and current account deficit. Furthermore, France's macro economic policy was counter cyclical to that of its neighbors. Nevertheless, by conducting secret and intra marginal intervention, France was arguably in the case described by Vitale, trying to "fool" the market by defending parity inconsistent with fundamentals. But the Banque de France adopted a certain management of realignments. By not allowing the exchange rate to go immediately to the new central parity within the new bands (which could overlap the former ones), speculators were hurt, because they had to close their short positions on the FRF at a higher level of the FRF exchange rate. This was a means of making intervention costly for the speculators but not the central bank.

The French franc was also heavily attacked in the 1992-1993 crisis. This crisis saw the exit of the GBP and the ITL from the EMS in September 1992, the devaluation of ESP and PTE by 6% on 22 November, a 10% devaluation of IEP on 30 January 1993, another 8% devaluation of ESP and 6.5% devaluation of PTE on 14 May 1993 and the widening of the fluctuation margins to +/- 15% on 2 August 1993, which marked the end of the crisis. For France, there was no devaluation, even with very large interventions, intra marginal but also at the margin, with the help of the financing mechanism of the EMS, of intervention and official support by the Bundesbank and the use of swaps. During that 1992-1993 period, the Banque de France remained secret about the timing and size of its intervention operations, except for a joint communiqué on 23 September 1992 from the German and French monetary authorities declaring that an adjustment of the

DEM/FRF rate was not justified. At the same time, the Banque de France announced an increase of key interest rates to 13%. The strategy followed in this period corresponds to what Obtsfeld (1994) describes in the second generation model of currency crisis. According to that model, there is an escape clause in government policy whereby there is a fixed penalty for abandoning the exchange rate peg and switching to a floating regime. The authorities then intervene to support the peg as long as the value of their loss function is less than the value of the loss with a switch to a float. The cost of invoking the escape clause can be viewed as the authorities' loss of credibility or as a wealth transfer to speculators if the attack is successful.

At that time, the political program of convergence to EMU was already well underway (the referendum on the Maastricht Treaty had received a positive answer) and the French government was determined to pursue its strong franc policy. The cost of giving up would have been highly detrimental for European monetary construction and the credibility of all European governments. Thus, secrecy of intervention and in the case of France of the size of the intervention operations was certainly the only solution and it was successful. Furthermore, speculators were reported to be severely hurt.

3. SECRECY ABOUT "WHEN AND HOW MUCH"

As hinted above by secrecy we must distinguish between *secrecy of the announcement* and secrecy about the scale of intervention.

Even if the central bank does not publicly announce that it has intervened, ex-ante or ex-post, in practice the market knows. In fact another channel though which intervention can be effective is the "two types of traders" channel (Montgomery and Popper 1997, Lyons 2001). The market includes informed or speculative traders who can distinguish between orders reflecting the arrival of private news about fundamentals and orders driven by liquidity needs. Uninformed or liquidity traders are driven by customers' needs. Interaction between the two types of traders may give rise to exchange rate dynamics that allow for an influence of official foreign exchange intervention. This channel can work even if intervention is carried out secretly.

In practice, at the Banque de France, intervention operations were conducted over the phone and via a restricted circle of large domestic banks and a few large foreign banks, in the Paris and London markets mostly. These banks understood quite rapidly when the quotes asked in the market were related to an intervention activity. But they preferred to get the information first and keep it secret as long as possible, because they had time to revert the positions created by the intervention to the circle of uninformed banks with a profit. At the same time, when the selling pressure was not too strong, after a first round of intervention, and if a second round of intervention was enhanced, the banks that were informed of our trade direction quoted in a biased way. It was not unusual in this case to buy instead of sell, meaning "leaning with the wind", creating some uncertainty and restoring a two-way bet. This kind of strategy and flexibility would not have been possible with full transparency.

The second point refers to the *secrecy about the scale of intervention* operations. Academics know the difficulties of obtaining this information, even after several years have passed. And, even by looking at balance sheets, which are generally published regularly (during the EMS period, the Banque de France published a weekly accounting statement), it is difficult to infer the amount of the intervention operations because of the specific accounting rules of the central banks and because of valuation effects. Nevertheless, in the target zone model literature, it is argued that if the central bank is "leaning against the wind", it should not reveal the size of the intervention. The experience of the Banque de France concurs with this assessment, because crises would have been much more difficult to resist and an exit out of the EMS to a floating exchange rate regime would have been much more probable, especially in 1993.

Nowadays however, with the implementation of the SDDS template of the IMF, transparency has progressed, official reserves having to be published every month, but with a one-month lag. But some reluctance remains in terms of clearly announcing the size of intervention to the market immediately after the event.
In its current configuration, ERM II may be an example of full transparency since Denmark announces the amount of intervention in a complete transparent way, as do the other members. But these countries may not be prone to currency crises, either be-

cause of their long track records in terms of credibility, e.g. Denmark, or because they are too small to induce large profits for speculators.

CONCLUSION

Lessons derived from the EMS experience as a practitioner tend to favor some secrecy in conducting foreign exchange intervention operations, especially in a target zone model. But this secrecy is not in opposition with the signaling channel. The central bank takes advantage of the asymmetry of information among market players. Nevertheless the question remains whether, if the strategy of the Banque de France had been different, the outcome might have been superior. But we will never know. Secrecy about the scale of intervention appears to play an important role in the success of an intervention.

The ERM II experience points to a change in attitude towards more transparency. We can see two main reasons behind this change. First, the Asian crisis demonstrated that the monetary authorities may, by trying to "fool" the market, trigger deeper financial crisis and reinforce contagion effects. Therefore being transparent and accountable has become a rule and duty of governance for central banks. Second, the participating countries are either small economies committed to join the euro and which, may be, do not constitute a challenge for speculators, due also to the small size of their financial markets. As far as Denmark is concerned, its exchange rate has been pegged for so long to the euro and the country has a so long track record in terms of credibility and integration in the euro area that the issue for secrecy or not is of a second order. But here, it remains to be seen what the behavior of the central banks of Poland or Hungary, for example, will be when they join the system.

In the euro area, the euro is freely floating and the ECB has clearly chosen to be transparent. The intervention operations carried out in September and November 2000 were publicly announced. Nevertheless, the size of the intervention was not, showing some lingering reluctance to be fully transparent, as long as immediate transparency is concerned.

It seems that flexibility in the way to carry out intervention

should remain, depending on the environment, the strategy followed as it has been recently showed by the Japanese authorities. This may serve as an illustration for Latin American monetary authorities which have shifted their exchange rate regimes towards managed floats with different fluctuation bands (from +/- 4% for Peru to +/- 26% for Brazil, and two countries, Uruguay and Chili, having adopted the standard ERM II fluctuation margins of +/- 15%).

Annex I

TABLE A. 1. A FEW LANDMARKS IN THE HISTORY OF THE EMS

22 March 1981	6% devaluation of ITL against all the other EMS currencies 2.54% revaluation of the ECU against all the EMS currencies
4 October 1981	5.5% revaluation of DEM and NLG against BEF, DKK and IEP 3% devaluation of FRF and ITL against DEM and NLG
21 February 1982	8.5% devaluation of BEF 3% devaluation of the FRF against the other EMS currencies New central rates against the ECU according to the new weights in the ECU basket
12 June 1982	4.25% revaluation of DEM and NLG against BEF, DKK and IEP 5.75% devaluation of FRF against DEM and NLG
21 March 1983	Realignment : DEM +5.5%, NLG +3.5%, DKK +2.5%, BEF +1.5% , NLG +3.5%, FRF -2.5%, ITL -2.5%, IEP -3.5% On the FX markets, this corresponds to: DEM +2%, DKK +3%, BEF +4%, FRF and ITL +8%, IEP +9%
17 May 1983	Adjustment of ECU central rates to due to the revaluation of 7.3% of GBP notional central rate; this gives rise to a 1.2% revaluation of the ECU against the other currencies in the basket
15 September 1984	Inclusion of GDR in the ECU and new definition of the ECU which has 10 currencies: DEM, FRF, GBP, ITL,NLG,BEF, DKK, GRD, IEP, LUF
20 July 1985	8% devaluation of ITL against the other EMS currencies (ITL -6%, the other currencies +2%)
6 April 1986	+3% revaluation of DEM and NLG, +1% revaluation of BEF and DKK, -3% devaluation of FRF
12 January 1987	+3% revaluation of DEM and NLG bilateral rates; +2% revaluation of BEF
12 May 1987	The Bank of Spain signs accession to EMS but does not for the time being imply the peseta's participation in the exchange rate mechanism
12 September 1987	Changes in the operating rules of the EMS – Basel/Nyborg agreement

TABLE A. 1 *(conclude)*

10 November 1987	The Bank of Portugal signs accession to EMS but does not for the time being imply the escudo's participation in the exchange rate mechanism
19 June 1989	Participation of the ESP in the exchange rate mechanism with a deviation band of */- 6%
8 January 1990	The fluctuation margins of ITL
4 April 1992	Entry of the PTE in the exchange rate mechanism
13 September 1992	7% devaluation of ITL against all EMS currencies, meaning a 3.5% devaluation of ITL and +3.5% revaluation of all other currencies
17 September 1992	UK suspends GBP participation in the EMS IT authorities refrain temporarily from intervening on FX markets on support of the ITL +5% revaluation of the EST
22 November 1992	- 6% devaluation of the ESP and PTE against all the other currencies
30 January 1993	- 10% devaluation of IEP against all the other currencies
14 May 1993	- 8% devaluation of ESP and – 6.5% devaluation of PTE against all other currencies
2 August 1993	Fluctuation bands are widened from +/-2.25% to +/-15%
7 January 1995	Austria's decision to participate in the EMS
6 March 1995	-3.6% devaluation of ESP and PTE against the other EMS currencies
12 October 1996	Entry FIM into the EMS
24 November 1996	Return of ITL in the EMS

Annex II

FIGURE A. I. NOMINAL EXCHANGE RATE DEVELOPMENTS IN ERM II IN 2005

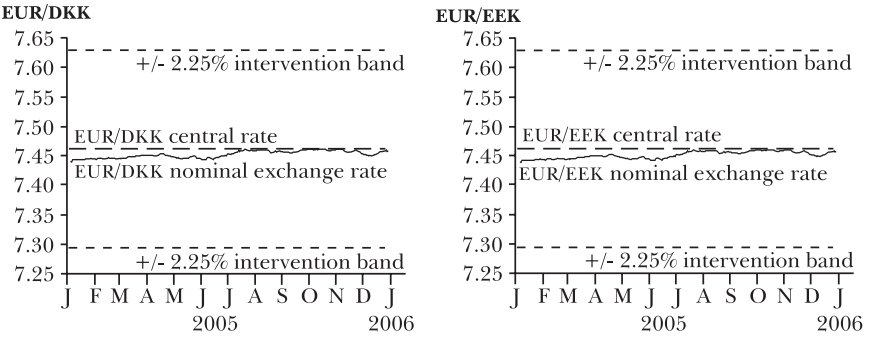
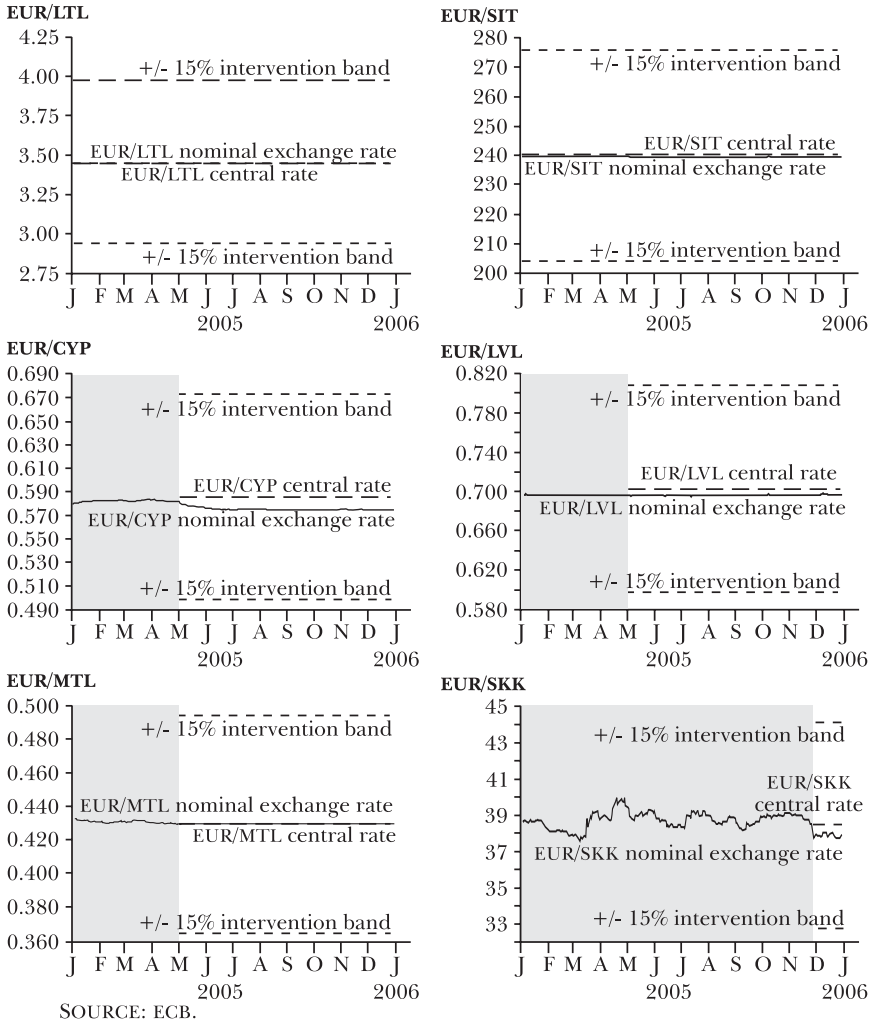


FIGURE A. I *(conclude)*



SOURCE: ECB.

Annex III

TABLE A. 2. SUMMARY OF INTERVENTION RESPONSES

	Nber of answers	*Mini-mum*	*Median*	*Maxi-mum*
1. In the last decade, on approximately what percentage of business days has your monetary authority conducted intervention	14	0.5	4.5	40.0

TABLE A. 2 *(conclude)*

2. Foreign exchange intervention changes The domestic monetary base	20	40	30	30
3. Interventions are conducted with:				
- major domestic banks	21	0	28.6	71.4
- Major foreign banks	18	16.7	72.2	11.1
- Other central banks	17	76.5	23.5	0
- Investment banks	16	68.8	25	6.3
4. Interventions are conducted in:				
- the spot market	21	0	4.8	95.2
- the forward market	17	47.1	52.9	0
- the future market	16	93.8	6.3	0
- Other	15	93.3	6.7	0
5. Interventions are conducted via:				
- telephone	20	0	30	70
- electronic communication	16	56.3	31.3	12.5
- live FX brokers	19	36.8	52.6	10.5
- electronic brokers	16	87.5	0	12.5
6. The following strategies determine the amount of intervention:				
- a prespecified amount is traded	17	17.6	70.6	11.8
- depends on market reaction to initial trades	20	5	55	40
7. Is intervention sometimes conducted through indirect methods such as changing the regulations for FX exposure of banks	21	76.2	23.8	0
8. The following factors for intervention decision:				
- to resist short-term trends	19	10.5	42.1	47.4
- to correct long-run misalignments	18	33.3	44.4	22.2
- to profit from speculative trades	17	100	0	0
- other	16	62.5	25	12.5
9. Interventions are conducted secretly for the following reasons :				
- to maximize market impact	17	23.5	35.3	41.2
- to minimize market impact	14	42.9	57.1	0
- for portfolio adjustment	11	100	0	0
- other	12	75	16.7	8.3
10. How long does it take to observe the full effect of interventions on exchange rates				
- a few minutes	18	38.9		
- a few hours	18	22.2		
- one day	18	0		
- a few days	18	27.8		
- more than a few days	18	11.1		
- has no effect	18	0		

SOURCE: J. Neely: *The practice of central bank intervention: looking under the hood.*

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Superintendencia de Bancos (Guatemala)
Comisión Nacional de Bancos y Seguros (Honduras)
Superintendencia de Bancos (Panama)
Banco Centroamericano de Integración Económica
Banco Latinoamericano de Exportaciones, S. A.
Deutscher Genossenschafts- und Raiffeisen-verband e.V. (German Cooperative and Raiffeisen Confederation)
Fondo Latinoamericano de Reservas