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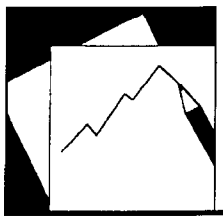

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Liberalization of Trade in Financial Services and Financial Sector Stability

(Empirical Approach)

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Liberalization of Trade in Financial Services and Financial Sector Stability
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Abstract

The paper explores empirically the links between the WTO-driven liberalization of trade in financial services and the stability of national financial systems. Econometric testing of indicators intended to proxy financial sector stability—subdivided into exchange rate and banking sector stability—suggests that opening of the financial sector is an efficient policy instrument at the disposal of the authorities for achieving a variety of macroeconomic goals. While liberalization is found to be broadly conducive to stability, the outcome of liberalization on exchange rate stability is less predictable than on banking sector stability.

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I. Introduction

"Martyrdom is the test."

Samuel Johnson, as quoted in
James Boswell's *Life of Johnson*, 1780

1. A companion paper, devoted to an analytical assessment of the interface between the World Trade Organization (WTO)-driven liberalization of trade in financial services and financial sector stability,[2] drew the following conclusions:

- Binding an achieved level of liberalization of the financial sector into international agreements is an important determinant, albeit one neglected until now, of financial sector stability. The WTO framework provides secure and transparent rules for liberalizing trade in financial services, thereby contributing to stability. The guiding principle is encouraging progressive, cautious, and adequately sequenced liberalization, not complete and meteoric liberalization. The criterion for the evaluation of its success at each phase is the degree of stability of the domestic financial system.

- Liberalization of trade in financial services, evolving in a complex web of other liberalization efforts, is conducive to financial stability, owing to their mutually reinforcing nature. In a number of key areas—current and capital account liberalization, prudential regulation, and international codes of good practices—there exists important complementarity between IMF and WTO rules and practices. This complementarity should be exploited to the fullest in the interest of ensuring financial sector stability.

- Future efforts to liberalize trade in financial services should be undertaken coherently by all stakeholders with the ultimate goal of ensuring financial stability. The WTO is neither the only, nor invariably the most effective, forum for discussion of market opening in financial services. A number of other international agencies are also involved in work on the financial sector—notably the IMF, the World Bank, and the Organization for Economic Cooperation and Development (OECD)—and have multilaterally agreed on instruments to promote their policy advice.

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[2] Alexei Kireyev, "Liberalization of Trade in Financial Services and Financial Sector Stability (Analytical Approach)," IMF Working Paper No. 02/138 (Washington: International Monetary Fund).

- Much work still needs to be done to distill the lessons of the past WTO-driven financial sector liberalization and its impact on financial stability. Among others, further development of an empirical analysis, using a variety of methodologies, is clearly needed to identify the channels of interaction between trade liberalization and financial stability.

2. Building on the above conclusions, the **purpose** of this paper is to explore empirically the economic links between liberalization of trade in financial services under the WTO and financial sector stability, in particular exchange rate and banking sector stability.[3] The empirical work is based on a specific econometric methodology, which, like any model or technique, is, at best, a crude approximation of reality. The methodology is based on testing for model constancy and various degrees of exogeneity of variables, which also helps one to assess whether a particular policy measure achieved the targeted outcome. The conclusions reached should be treated as tentative, as much additional work is needed on the base of the methodology itself, which is essentially an extension of a method applicable to a timeseries to a panel of three-dimensional data (countries, economic variables, and time), and on testing of additional variables (which is most important in the practical analysis), including different definitions of openness, the exchange rate, and banking crisis.

3. **The remainder of the paper is organized as follows.** Section II reviews the recent literature on the relationship between financial liberalization and stability and outlines the methodology used in the empirical analysis. Section III applies the methodology with a view to establishing economic links between the financial services liberalization undertaken by countries under the WTO General Agreement on Trade in Services (GATS) and the stability of their financial systems, subdivided into their exchange rate systems and banking system. Finally, Section IV presents some concluding remarks.

II. Financial Services: Trade and Stability Nexus

A. Recent Literature at a Glance[4]

4. **There is an ample literature on financial sector liberalization**. Particular attention has been paid to the issue of the determinants of financial sector stability and vulnerability, quantification of countries' commitments in financial services liberalization, identification of the modes of supply of financial services most affected by liberalization commitments and

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[3] This paper may be read in conjunction with the conclusions reached in the paper in Valckx (2002), who analyzed WTO commitments in the liberalization of financial services, their determinants, and impact on financial stability, and found that more extensive, more liberal commitments in financial services seemed to reduce the risk of currency crises but tended to raise the likelihood of banking problems.

[4] Mr. N. Valckx (Geneva Office summer intern 2001) has contributed to the preparation of this section.

construction modal bias and liberalization indices, as well as to the contagion and spillover effects of financial instability. In the context of financial services liberalization in the WTO, the most comprehensive studies were prepared in the late 1990s, immediately after the conclusion of the GATS. A broad analysis of the state of play is provided in Dobson and Jacket (1998), Kono et al. (1997), Key (1997), and most recently, Mattoo (2000), Sauvé and Steinfatt (2001), and WTO (2001). World Bank (2001) includes comprehensive coverage of the issues and lessons in the internationalization of financial services as they relate to developing countries. Finally, a number of recently released IMF/World Bank financial stability assessment reports and their methodology provide a valuable source on the actual macroprudential situation in a number of countries, their regulatory systems, the degree of observance of standards and codes, and their susceptibility to exogenous shocks.

5. **A significant part of the existing literature measures financial sector (in)stability and vulnerability mainly by singling out the periods identified as either currency or banking crises.** Demirgüç-Kunt and Detragiache (1998) and Goldstein et al. (2000) do so by assigning a 0-1 dummy variable to the corresponding incidence. Alternatively, Johnston et al. (2000) suggests aggregate (continuous) variables of financial sector (in)stability and vulnerability. For a banking crisis, it is a high volatility or strong decrease of bank asset values, a high ratio or major increase of non-performing loans to total loans, a low or considerable decline of the capital-to-assets ratio. For a currency crisis, these include large currency depreciations, high exchange rate volatility, depletion of international reserve assets. For a balance of payments crisis, it is a high level (relative to GDP) and/or high volatility of (short-term) capital flows, a high ratio of portfolio flows to FDI, low capital inflows and high outflows, a huge and unsustainable current account deficit. Along the same lines, White (2000) distinguishes three forms of financial instability: short-term (asset price) volatility; medium-term misalignments and bubbles (including excessive capital flows);and contagion across both markets and countries.

6. **A number of studies have tried to quantify countries' WTO commitments in financial services liberalization.** There are a number of studies that have quantified country levels of commitments under GATS. Hoekman (1996), and Hoekman and Braga (1996) compiled overall and sectoral indices of commitments for all GATS members, using values of 0, 0.5 and 1 for 'unbound', 'bound,' and 'none', respectively, relative to the maximum number of sectors listed in GATS. Sorsa (1997) contains an annex of selected countries GATS market access commitments in banking, securities and other financial service sectors, differentiated by mode of supply and by conditionality. Kono et al. (1997) presents summary tables of GATS commitments for four country groupings (developed, transition, developing, and least developed), for the period 1993–95. WTO (1998) contains a summary list indicating whether countries have specific commitments in financial services (banking, insurance, securities, and others, with a total of 12 subcategories). Mattoo (2000) focuses on the market access commitments undertaken by 105 countries in banking (acceptance of deposits and lending of all types) and direct insurance (both life and non-life) as of December 1997.

7. **Some studies aim at identifying the modes of supply of financial services most affected by liberalization commitments and constructing modal bias and liberalization indices.** For example, Kono and Schuknecht (2000) provide quantitative indicators of the level of market access commitments in core banking (deposits, lending, and foreign exchange operations) and securities (trading and underwriting) under modes 1 and 3, and of restrictions on practices by foreign establishments, for 27 developing countries. They construct measures of modal bias (determining whether mode 3 is more committed than mode 1, or vice versa), lending bias (determining whether lending activity is more liberalized than securities business) and of restrictiveness for foreign establishments. Qian (2000) also tabulates the 1997 Protocol on Financial Services (in banking only, insurance is not covered) and constructs liberalization indices using a specific weighting scheme taking into account the importance of modes 1, 2 and 3 (based on available U.S. data), and values for the respective commitments (0, 0.25, 0.50, 0.75 and 1). A related study by Nicoletti (2001) uses factor analysis to classify OECD countries with respect to their state of service regulation along a cardinal scale from least to most restrictive (0 to 6). Data are collected from the OECD International Regulation Database, covering over 1,100 observations per country, on industry-specific (telecom, transport, electricity supply services) and economy-wide regulations, such as on entry and administrative ease of startups).

8. **Finally, the numerous studies on financial contagion and spillovers are also relevant for the subject of this paper.** Goldstein, Kaminsky, and Reinhart (2000) provide a broad review of the existing approach to assessing financial vulnerabilities, with special emphasis on early warning systems. Kaminsky, Lizondo, and Reinhard (1998) include a comprehensive review of the literature on the leading indicators of financial crisis, relating exclusively to currency crisis. Yet, they conclude that a banking crisis appears to be one of the more important factors in generating a currency crisis, and the determinants and leading indicators of a banking crisis should be amenable to the same type of quantitative analysis as are currency crises. The IMF/World Bank methodology of financial stability assessment and a number of country reports released to date represent also a valuable source.[5]

B. Data and Methodology

9. **The methodology used for econometric analysis is based on the methodology suggested in Kireyev (2001) and applied to a panel—repeated observations over a number of countries collected over a number of consecutive periods.** The ultimate goal of the methodology used is not so much to construct a fully congruent model of the determinants of financial sector stability, although the model should be reasonably plausible. Rather, the goal is to uncover properties of a measurement of financial sector openness—one of the determinants included in the model by definition—and its impact of financial sector stability. Thus, the generic form of the model is

$$Y_t = \alpha + \beta X_t + \gamma Z_t + \delta i + \varepsilon_t \qquad (1)$$

[5] Available on the IMF website at www.imf.org.

with $\varepsilon_t \sim IN(0,\sigma^2)$ and $t = 1,2...T$, where Y_t is a *target variable* that is endogenous to the model and is supposed to capture financial sector instability; X_t is a vector of *control variables* that are considered to be the prime determinants of the trend in the target variable; Z_t is a vector of *transmission variables* that are most influenced by a particular liberalization step in the financial sector; and i is a step or an impulse *dummy* designed to capture the time effect of a liberalization measure[6]; ε_t is a white noise random disturbance, with zero mean and fixed variance. Using a test for different degrees of exogeneity, the methodology helps uncover the properties of the transmission variable (in this case degree of openness of financial markets) and its impact on one of the indicators that capture the degree of financial sector stability.

10. The data generating process of (1) is generally unknown but can be approximated by an econometric modeling of a subset of variables in the full model x_t conditional on the other variables in x_t. Following Ericsson, et al. (1998), and Hendry and Mizon (1998), without loss of generality, the full model x_t can be partitioned into conditional model y_t and marginal model, z_t, i.e., $x_t = (y_t' ; z_t')'$:

Conditional model of y_t given z_t i.e. $(y_t | z_t)$ is:

$$y_t | z_t = \alpha_0 + \alpha_1 z_t + \upsilon_t \tag{2}$$

where $\upsilon \sim IN(0,\Omega)$.
Marginal model of z_t is

$$z_t = \beta_0 + \beta_1 z_{t-1} + \varepsilon_t \tag{3}$$

where $\varepsilon \sim IN(0,\Theta)$.
The relationship between the conditional and marginal models is

$$F_x(y_t, z_t | x_{t-1}, \theta) = F_{y|z}(y_t | z_t, x_{t-1}, \lambda_1) F_z(z_t \mid x_{t-1}, \lambda_2) \tag{4}$$

where $F_z(x_t,\theta)$ is the joint density of x_t; $F_{z|z}(y_t | z_t; \lambda_1)$ is the conditional density of y_t given z_t; and $F_z(z_t;\lambda_2)$ is the marginal density of z_t. The parameter vector θ is the full set of parameters in the joint process; $\lambda_1 = (\alpha_0, \alpha_1, \Omega)'$ and $\lambda_2 = (\beta_0, \beta_1, \Theta)'$ are the parameters of the

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[6] If the liberalization measure has been introduced in one go (i.e., by an executive order effective on a particular date), and relatively consistent efforts along its lines have continued thereafter, then a step dummy taking the value of zero before the measure, and the value of one in the year of the reform and thereafter, can be used; if the measure has been reversed at some later date, then an impulse dummy taking the value of one in the year(s), when the measure was in effect, and zero otherwise, may be appropriate.

conditional and marginal models respectively; and x_{t-1} is a set of original conditions. The reform dummy variable i can be included either in the conditional or in the marginal model.

11. **Reform steps aimed at the liberalization of the financial sector are treated as an instantaneous reform**. Their purpose is to shift the mean of the target variable Y_t in the conditional model y_t to a desired value or within a desired range by using the instruments Z_t in the marginal model z_t available to governments.[7] Thus, y_t can be viewed as a model of factors ultimately determining Y_t, and z_t as a model of policy instruments affecting Y_t through their impact on y_t. Accordingly, the purpose of econometric modeling is to assess the effects on the data generating process (DGP) of changes in economic policy implemented by the manipulation policy instruments on the path of the partial response of the target variables. Economic reforms typically assume that changes in the instruments in z_t have an impact on the targets Y_t. This implies that the following conditions should hold: (i) variables in x_t must be cointegrated, i.e., there should exist a long-run economic relationship between them; (ii) causal links should lead from instruments X_t to targets Y_t; and (iii) the instruments in the marginal model z_t must be manipulable, suggesting that the governments should be able to set instruments to the desired values.

12. **The econometric model cannot be expected to coincide with the economic process under consideration, but it should approximate the data generating process accurately and should not be misspecified.** The underlying assumption of testing reforms by testing exogeneity is that the relevant econometric model is conditional on the policy instruments that can be used to alter the target variables. Thus, cointegration, exogeneity, causality, invariance, and impulse response are the key elements needed to estimate the impact of changes in a policy regime on any macroeconomic parameters of interest. Appendix I presents possible economic interpretations of the corresponding econometric properties, if they are detected in the process of statistical analysis of the underlying data.

13. The number of steps needed to estimate consistently and interpret meaningfully the above properties depend on the properties of the underlying data and the results obtained at each step. The **estimation sequencing** is the following:

- Build a congruent full model x_t by selecting relevant variables and the functional form
- Check for cointegration of variables in x_t;
- If the cointegration property is detected, break x_t into y_t and z_t ;
- Test for weak exogeneity of Z_t;

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[7] Variables are shown in uppercase; their models are shown in lowercase. In cases when the variable means a modeled variable, lowercase is used.

- Check for the direction of Granger causality between Y_t and Z_t;
- Check for constancy of λ_1 in the conditional model by Chow test;
- Construct a congruent ARMA(p,q) model for z_t ;
- Check for constancy of λ_2 in z_t by Chow test or by Bai and Perron (1998);
- Augment z_t using dummy variables (including the reform dummy) until it becomes empirically constant;
- Augment the original model by plugging in the dummies capturing instabilities in the marginal model and check for their significance;
- Compare impulse response functions of x_t and y_t to check the validity of conditioning;
- Provide comparative interpretation of the results.

14. **This approach has obvious limitations, set out in detail in Kireyev (2001), and its application in the literature is at a preliminary stage; therefore, the results should be treated as suggestive only.** The exogeneity testing is based on a number of strong assumptions: (i) the equation for the target variable is correctly specified and control variables capture all its significant determinants; (ii) the transmission variable is correctly selected to represent the impact of an instantaneous reform; (iii) no other variables, which may be correlated with the transmission variable, are important for the target variable and they can be disregarded. The relevant question to ask about these assumptions is not whether they are descriptively "realistic," for they never are, but whether they are sufficiently good approximation for the purpose in hand. This paper asserts that the answer to this question is positive.

15. **The dataset used is broadly that prepared by Valckx (2002) for 92 countries**. It is drawn from the World Bank Development Indicators and IMF *International Financial Statistics* for 1991–99. The requirement of the applied methodology to have a full dataset for each country triggered the reduction of the number of countries under consideration from 92 to 66 and limited the number of macroeconomic indicators considered. The dataset includes macroeconomic data [GDP per capita, annual real GDP growth, inflation rate, gross domestic savings (percent of GDP) M2 money and quasi-money, as a percent of GDP]; balance of payments data (current account balance; openness indicators, and capital inflow and outflow indicators); fiscal policy indicators (overall budget deficit, total debt service); financial market indicators (interest rate spread, real interest rate); bank soundness indicators (reserves-to-assets ratio, reserves-to-deposits ratio, loans-to-deposits ratio, growth of loans); exchange rate indicators (SDR exchange rate volatility); as well as financial crisis and liberalization dummies. All estimations are performed on stacked data, with each column representing a variable and the data for each country stacked on top of one another.

16. **Modeling the link between liberalization and financial sector stability is subdivided into exchange rate stability and banking sector stability**. There is no consensus in the literature on how best to specify and measure financial sector stability for the purposes of empirical analysis and previous attempts have inevitable shortcomings. For the purposes of this paper, the *target variables* are defined as annual deviations of local currency exchange rates against SDR for approximating exchange rate stability and the fluctuation of reserve/deposits

ratio for approximating banking stability. In both cases the *transmission variable* is the level of openness of trade in financial services—exports plus imports of financial and insurance services as percent of GDP. The set of *control variables* is separately determined econometrically for exchange rate and banking stability analysis. Finally a set of step dummies was used to approximate a lasting effect of the end of substantive negotiations on financial services in 1993, the entry into force of the GATS in 1995, and the conclusion of the Fifth Protocol to GATS in 1997. A set of impulse dummies for the same years was also used to test for an instantaneous effect of each of these events.

III. Past Liberalization and Stability: Have They Been Cointegrated?

A. Liberalization and Exchange Rate Stability

17. **General-to-specific search for a full autoregressive distributed lag (ARDL) model of exchange rate volatility yields a model with relatively weak explanatory power**. As should be expected from a heterogeneous panel, in the period under examination, exchange rate stability (the target variable in the used convention) depended mainly on its past volatility, real growth, level of money supply, reserve/deposit ratio and current account trends (control variables), and the level of financial sector openness, treated as a transmission variable (Table A.1.1).[8] Augmenting the full model sequentially by three step dummies, designed to capture the psychological effects of major events in trade in financial services liberalization, reveals substantial statistical significance of each of these steps (Table A.1.2). In addition, including the step dummies one at a time improves the statistical significance of the openness variable, which embodies the results of financial sector liberalization. Further augmentation of the model by including the step dummies two at a time improves the explanatory power of the openness indicators even further, clearly pointing to the interlinkage and reinforcing nature of the two indicators of financial services liberalization. Neither combination of impulse dummies, nor their combination with step dummies, produces any noticeable impact on the model (Table A.1.3). This implies that liberalization may have had a sustained impact on exchange rate stability.

18. **The next step is to find out whether the openness property is variable, and primarily, whether the full model should be conditioned on it.** The cointegration analysis of the full model using the Johansen procedure of eights-order vector autoregression (VAR), as selected by the Scwartz and Akaike information criteria, rejects the null hypothesis of no cointegration in favor of at least two cointegration relationship with two large eigenvalues and four small eigenvalues (Table A.2.1). With two cointegrating vectors, the interpretation of the long-term co-movements in the time series becomes somewhat ambiguous, but nevertheless, the same existence of cointegration suggests consistency in the internal dynamics of the model. By putting the corresponding row of the speed-of-adjustment coefficients in the α matrix to zero and under the assumption of two cointegrating vector, the LR-test accepts weak exogeneity of

[8] See Appendix Tables.

openness variable in the conditional model (Table A.2.2). Thus, the openness indicator seems weakly exogenous, and a disequilibrium in the cointegrating relationship does not feed back into the conditional model. Consequently, the measures affecting the level of openness can be considered an efficient policy instrument at the disposal, and under effective control, of the authorities. It is set exogenously from the conditional model and can be used to affect the target variable. Moreover, owing to the exogeneity property of the transmission variable, there is no need to model it separately, because the conclusions derived from the conditional model alone are deemed to be accurate and valid.

19. **Although the weak exogeneity of the transmission variable seems to suggest that opening of the financial sector is an efficient policy instrument, it does not by itself mean that this particular instrument can affect favorably the target variable, i.e., exchange rate stability.** In the case of the liberalization measures under consideration, weak exogeneity of the transmission variable is not complemented by Granger causality in any direction (Table A.2.3). It suggests that the measures that increase openness may not have had a pronounced impact on the target variable in the past. A conjunction of weak exogeneity and Granger non-causality means that the transmission variable is strongly exogenous for the conditional model. Thus, the past history of liberalization, which in many countries may have started well before any agreement on services reached in the GATT/WTO framework, apparently has not had any visible impact on the liberalization decisions taken in recent years. Although empirically the past history of the financial sector reforms seems not to have had any particular influence on the decisions to liberalize further trade in financial services taken in the second half of the 1990s, many countries have definitely built on their past liberalization experience—both its positive and negative aspects—in planning future liberalization steps.

20. **A parameter constancy check of the conditional model was performed by recursive statistics using one-step ahead residuals (forecast error) with an approximate 95 percent confidence interval, the scaled log-likelihood, and the breakpoint Chow statistics** (Table A.2.4). The recursive plots suggest a significant inconstancy of parameters and of the conditional system as a whole. Weak exogeneity of the transmission variable is supplemented by the variance of the conditional model to the interventions that occur in the marginal process, suggesting that the parameters of the conditional model are not super exogenous for the innovations occurring during the sample period. Therefore, the liberalization measures seem to have had an impact on the target variable both through the transmission variable entering the conditional model and also its parameters. Thus, reliable policy simulations require simultaneous modeling of the conditional and the marginal process, i.e., the path of the transmission variable should be modeled separately.

21. **Absence of super exogeneity property of the transmission variable has also been verified by checking the constancy of a simple marginal process.** If the conditional model had constant parameters but the marginal model does not, then the conditional model parameters could not depend on the marginal model parameters. The marginal model for the openness indicator has been specified as a simple univariate ARMA (2, 0) process (Table A.3.1). The model looks correctly specified (Table A.3.2), but is still unstable, although the degree of variability is much less than that of the conditional model and only marginally

passes the standard tests for parameter stability (Table A.3.3). This conjuncture of parameter instability in the conditional model and its instability in the marginal model together with weak exogeneity property clearly support the rejection of super exogeneity of the openness variable in the conditional model. The absence of this property is critical for correct interpretation of a policy simulation: the measures to increase openness have had an impact on exchange rate stability through the transmission variable entering the conditional model and affecting the value of the parameters in that model. Augmenting the marginal model by sequentially introducing the set of dummies, did not induce empirical constancy into the model, and only the 1993 dummy was statistically significant.

22. **Summing up, the following tentative interpretation of the findings stems from the exogeneity analysis of the financial openness indicator in a model of the determinants of exchange rate stability in 1991–99**:

- the liberalization of trade in financial services can be considered an efficient policy instrument at the disposal, and under effective control, of the authorities, useful for achieving a variety of macroeconomic goals (weak exogeneity property);

- nevertheless, the liberalization of trade in financial services by itself is insufficient for improving exchange rate stability, which requires implementation of additional policy measures (Granger causality property);

- past experience of liberalization of trade in financial services is largely irrelevant for steps undertaken in the 1990s, most probably because most countries were not ready—economically and politically—for liberalization, and there were no previous attempts at liberalizing such trade in the GATT/WTO framework, as services were outside the scope of the GATT (absence of strong exogeneity);

- the impact of the liberalization of trade in financial services on exchange rate stability was different (which does not mean negative) from that anticipated by authorities (instability property);

- an impact of any new liberalization measures on exchange rate stability cannot be reliably simulated from the model of the exchange rate alone, but requires a parallel search for the determinants of the openness indicator itself (super exogeneity property).

B. Liberalization and Banking Sector Stability

23. **As was the case with the exchange rates, the search for a model of the determinants of banking sector stability yields a model with relatively weak explanatory power**. Banking stability, as defined above, mainly depended on the fluctuations of the savings rates, demand for loans, trade balance trends, its own past volatility, real growth, level of money supply, reserve/deposit ratio, and current account trends (Table A.4.1). The degree of financial sector openness, which embodies the results of financial sector liberalization and is treated as a transmission variable, was marginally significant only at a 10 percent level. Augmenting the full

model sequentially by three step dummies reveals statistical significance only for the dummy approximating the 1997 conclusion of the Fifth Protocol. Contrary to the exchange rate case, the inclusion of step dummies in all possible combinations failed to improve the statistical significance of the openness variable, seemingly indicating weak interlinkages between the two proxies of financial liberalization. No combination of impulse dummies, nor their combination with step dummies, produces any noticeable impact on the model.

24. **The cointegration analysis using the seventh-order VAR rejects the null hypothesis of no cointegration in favor of at least two cointegration relationships with two large eigenvalues and four small eigenvalues** (Table A.4.2.a). By putting the corresponding row of the speed of adjustment coefficients in the α matrix to zero and under the assumption of two cointegrating vector, the LR-test accepts weak exogeneity of openness variable in the conditional model (Table A.4.2.b). Therefore, consistent with the exchange rate case, the measures affecting the level of openness of the banking sector can be considered an efficient policy instrument at the disposal of, and under effective control by, the authorities. It is set exogenously from the conditional model and can be used to affect the target variable. Moreover, owing to the exogeneity property of the transmission variable, there is no need to model it separately, because the conclusions derived from the conditional model alone are deemed to be accurate and valid.

25. **Weak exogeneity of the transmission variable confirms that opening of the financial sector is an efficient policy instrument for achieving a variety of economic goals in the financial sector.** This does not imply, however, that this particular instrument can be operational in favorably affecting the target variable, approximating banking sector stability. In the case of the liberalization measures under consideration, weak exogeneity of the transmission variable is not complemented by Granger causality in any directors (Table A.4.2.c). It suggests that the measures increasing openness have not had a pronounced impact on the target variable in the past. A conjunction of weak exogeneity and Granger non-causality means that the transmission variable is strongly exogenous for the conditional model. Thus, the past history of liberalization, which in many countries may have started well before any GATT/WTO agreement on services, has not had any visible impact on the liberalization decisions taken recently. This conclusion is again consistent with the results reached in the exchange rate case.

26. **However, contrary to what was found in the exchange rate case, a standard test of the conditional model suggests a visible constancy of parameters and of the conditional system as a whole** (Table A.4.2.d). Weak exogeneity of the transmission variable is supplemented by the invariance of the conditional model, suggesting that the parameters of the conditional model are super exogenous for the innovations occurring in the marginal process during the sample period. Therefore, the liberalization measures seem to have had an impact on the target variable only through the transmission variable entering the conditional model, but not its parameters. This means that for a reliable policy simulation, it is sufficient to model the conditional process alone, with the path of the transmission variable as one part of it. Parameter constancy of the conditional model may suggest that the impact on banking stability of liberalization of trade in financial services was broadly consistent with that anticipated by authorities.

27. **Summing up, the analysis of the financial openness indicator's properties in a model of banking stability in 1991–99 suggests the following tentative conclusions**:

- the liberalization of trade in financial services can be considered an efficient policy instrument at the disposal of, and under effective control by, the authorities, useful for achieving a variety of macroeconomic goals (weak exogeneity property);

- nevertheless, the liberalization of trade in financial services, by itself, is not sufficient for improving banking stability, which requires implementation of additional regulatory measures (Granger causality property);

- past experience of liberalization of trade in financial services is largely irrelevant for steps undertaken in the 1990s, again probably because there were no previous attempts at liberalizing such trade in the GATT/WTO (absence of strong exogeneity);

- the impact on banking stability of the liberalization of trade in financial services was broadly in line with authorities' expectations; and

- the impact of any new liberalization measures on banking stability can be reliably simulated from the model of the banking stability alone; there is no need to model the openness indicator separately (super exogeneity property).

IV. Conclusions

28. **Financial liberalization and stability go hand in hand; they are cointegrated.** Econometric testing of indicators intended to proxy both exchange rate and banking sector stability suggests the following general conclusions:

- Opening of the financial sector can be viewed as an efficient policy instrument at the disposal of, and under effective control by, the authorities for achieving a variety of macroeconomic goals.

- Reform steps leading to liberalization of trade in financial services are not sufficient in themselves to ensure financial sector stability and need to be accompanied by other macroeconomic and regulatory measures.

- Past experience of liberalization does not seem to be particularly relevant for recently taken liberalization decisions and may not be particularly important for any decisions to be taken in the future; such decisions would have to reflect the realities of the time.

- In the past, the impact of liberalization on exchange rate stability was different from what the government originally envisaged, whereas the impact of liberalization on banking sector stability was broadly in line with expectations; the difference in the impact does not imply a negative outcome, but simply means that a number of results often could not be foreseen.

- Finally, the estimation seems to suggest that the overall outcome of liberalization on exchange rate stability is less predictable than on banking sector stability, possibly because the exchange rate is a product of the interface between the national economy and the outside world, while the banking sector is still mainly a domestic phenomenon and is under tighter control by the authorities.

Exogeneity Testing: Quick Reference Map

Property	Status	Interpretation
Cointegration	detected	There are long-term co-movements in the full model x_t. The suggested testing procedure can be applied.
	not detected	There are no long-term co-movements in the full mode x_t. The suggested testing procedure cannot be applied.
Weak exogeneity	detected	Policy instruments z_t are set exogenously outside the conditional submodel y_t. The government has full control over these instruments and can effectively manipulate them. Conclusions based on the conditional submodel y_t alone are accurate and valid.
	not detected	Policy instruments z_t are an endogenous part of the full model x_t. They cannot be treated as determined outside the conditional model, and should be modeled as a separate submodel. The government cannot set its policies independently of other developments in the economy or effectively manipulate this policy instrument. Conclusions based on the conditional submodel y_t alone are neither accurate nor valid.
Granger causality	detected	z_t is a potential instrument for changing the target y_t. Policies z_t have effect on target variable y_t. The policies are applicable y_t and z_t must be forecasted together within the full model x_t, one period at a time.
	not detected	z_t is not the right instrument for changing the target y_t. Policies z_t do not have effect on target variable y_t. The policies are not applicable. y_t and z_t can be forecasted separately: first forecasts of z_t over several periods can be constructed and then forecast for y_t can be generated from the conditional submodel alone.
Strong exogeneity = (weak exogeneity + Granger non-causality)	detected	Past history of the reform has no impact on the reform decision taken today. Information on previous attempt of a particular reform can be disregarded.
	not detected	Past history of the reform is important for and is taken into account for the reform decision taken today.
Invariance	detected	Effects of policies z_t on the target variable y_t are as anticipated.
	not detected	Effects of policies z_t on the target variable y_t are other than anticipated.
Super exogeneity = (weak exogeneity + invariance)	detected	The reform has an impact on the target variable through the transmission variable entering the conditional model and does not affect the value of the parameters in that model. The conditional model alone can be used for reliable policy simulation.
	not detected	The reform has an impact on the target variable through both the transmission variable entering the conditional model and its parameters. The path of the transmission variable should be modeled separately. Reliable policy simulation requires simultaneous modeling of the conditional and marginal process.
Differences in **impulse responses** between full and conditional models	detected	May mean incorrect conditioning. If conditioning is proved to be valid, suggests that a shift in the marginal model induced by the reform propagated into the conditional model.
	not detected	Conditioning is valid. Shifts in the marginal model induced by the reform do not propagate into the conditional model.

Table A.1. Exchange Rate Stability: Analysis of Properties

ARDL:	Full model	Augmented model						
Variables								
Constant	2269.8	-1117.9	785.31	1521.6	-896.56	-677.32	-670.24	2330
t-stat.	0.844	-0.364	0.284	0.5726	-0.291	-0.22	-0.218	0.839
VOL_1	0.59957	0.6018	0.5985	0.5965	0.6005	0.5988	0.5987	0.5993
t-stat.	18.375	18.5	18.395	18.346	18.443	18.414	18.395	18.306
OPEN	-308.44	-353.05	-346.36	-346.4	-360.86	-368.88	-369.12	-309.71
t-stat.	-1.44	-1.647	-1.616	-1.62	-1.682	-1.723	-1.722	-1.442
GDP_1	418.2	361.8	334.02	369.89	330.81	341.55	339.47	410.3
t-stat.	1.94	1.673	1.529	1.716	1.515	1.58	1.555	1.878
M2GDP	-65.439	-72.48	-74.106	-77.829	-75.275	-79.902	-65.858	-66.186
t-stat.	-1.725	-1.91	-1.948	-2.042	-1.979	-2.097	-2.096	-1.738
RDEP	3564.5	3613.1	3608.8	3637	3623.4	3654.3	3654.1	3569.6
t-stat.	2.574	2.618	2.614	2.637	2.625	2.652	2.65	2.571
CA	181.19	201.93	201.38	211.73	207.05	219.21	219.19	182.79
t-stat.	1.259	1.405	1.401	1.472	1.44	1.525	1.523	1.266
Dummies:		Step						Impulse
Dum 93		5299.3			3598.8	3709.6	3608.3	-465.32
		2.261			1.25	1.48	1.254	-0.149
Dum 95			4237.4		2471.2		207.5	-630.44
			2.14		1.016		0.072	-0.202
Dum 97				5081.1		3909.8	3807.8	1146
				2.462		1.771	1.449	0.366
Diagnostics								
R^2	0.379068	0.3844	0.3839	0.3854	0.3855	0.3877	0.3793	0.3793
F- statistic	59.624	52.195	52.072	52.414	45.802	46.229	39.587	39.587
	(6,586)	(7,585)	(7,585)	(7,585)	(8,584)	(8,584)	(9,583)	(9,583)
Sigma	23353.4	23272	23282	23253	23271	23230	23409	23409
D-W	1.97	1.97	1.97	1.96	1.97	1.97	1.97	1.97

Memorandum:
t-stat critical values:
Two-sided test, with $n>120$
1-percent significance: $t>2.57$
5-percent significance: $t>1.96$
10-percent significance $t>1.282$
D-W denotes the Durbin-Watson statistic

Table A.2. Conditional Model Analysis

1. Cointegration (VAR)

*H*o:rank=*p*	-*T*log(1-\mu)	using *T-nm*	95%	-*T*\Sum log(.)	using *T-nm*	95%
p == 0	179.8**	28.39	39.4	314**	49.58	94.2
p <= 1	87.29**	13.78	33.5	134.2**	21.19	68.5
p <= 2	25.42	4.01	27.1	46.91	7.41	47.2
p <= 3	15.04	2.38	21.0	21.49	3.39	29.7
p <= 4	6.44	1.02	14.1	6.45	1.02	15.4
p <= 5	0.01	0.00	3.8	0.01	0.00	3.8

Standardized beta' eigenvectors

M2GDP	*OPEN*	*RDEP*	*VOL*	*CA*	*GDP*
1.000	-17.634	25.895	0.041	8.873	37.038
-0.394	1.000	-8.469	-0.009	-0.326	1.968
-0.002	0.102	1.000	0.000	0.101	-0.163
3266	-2993	10176	1.000	-6072	18633
12.121	-192.440	-630.730	0.217	1.000	259.410
0.139	1.740	-27.831	0.016	-4.008	1.000

Standardized alpha coefficients

M2GDP	0.3441	0.8673	4.2404	-0.0002	-0.0149
OPEN	0.0130	-0.0265	5.0107	0.0000	0.0014
RDEP	-0.0218	0.0555	-0.3150	0.0000	-0.0001
VOL	-204.41	-0.5576	-2.7389	0.1144	14.8410
CA	-0.0342	0.1566	15.8010	0.0000	-0.0006
GDP	-0.1054	0.0243	0.8731	0.0000	0.0000

2. Weak exogeneity (zero restriction on alpha matrix, 2 cointegrating vectors)

Standardized beta' eigenvectors

CA	*GDP*	*M2GDP*	*OPEN*	*RDEP*	*VOL*
265.0692	871.0173	27.7660	-484.0428	-84.7161	1.0000
-0.1599	-1.9249	-0.0299	1.0000	12.2835	0.0007

Standardized alpha=A/theta coefficients

CA	-2.0074	-1.1061
GDP	-0.6877	-0.0756
M2GDP	-5.2610	-3.8512
OPEN	0.0000	0.0000
RDEP	-0.1323	0.2733
SDR	3593.9	3920.7

LR-test, rank=2:

$Chi^2(2) = 4.6494$ [0.0978]

3. Granger causality

Null	*F*-Stat.	Prob.
SDR does not cause *OPEN*	0.7	0.69625
OPEN does not cause *SDR*	0.3	0.95059

4. Stability

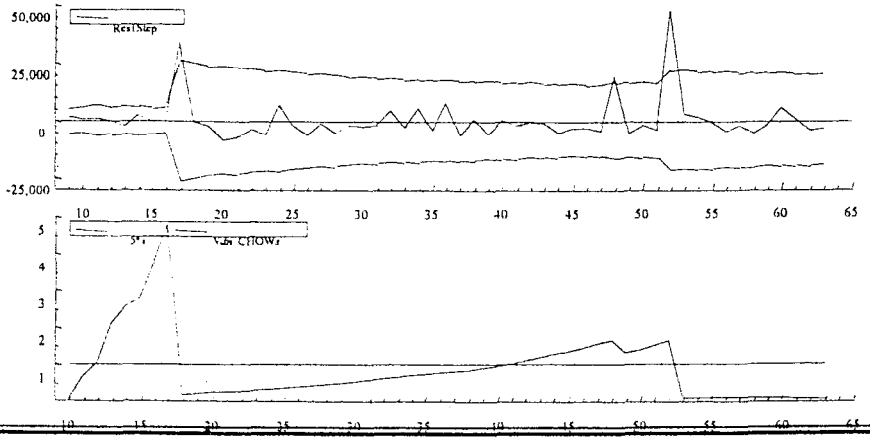


Table A.3. Marginal Model Analysis

Model			
ARMA		**Full model**	**Augmented model**
Constant		17.7410	1.2198
	t-stat.	2.3930	3.1920
AR(2)		0.3700	0.6539
	t-stat.	3.0760	19.6570
AR(7)		0.1885	-0.0884
	t-stat.	2.0360	-2.6500
Dum 93*s*			1.3940
	t-stat.		3.9780
Diagnostics			
R^2		0.2188	0.4082
F		7.5609	133.8300
		(2,54)	(3, 582)
Sigma		26.1679	3.51715
D-W		2.27	2.16
AR 1- 2 *F*(2, 52)	0.62733 [0.5380]		
ARCH 1 *F*(1, 52)	1.9759 [0.1658]		
Normality $Chi^2(2)$	1.9359 [0.3799]		
Xi^2 *F*(4, 49)	0.59436 [0.6684]		
*Xi***Xj* *F*(5, 48)	0.5342 [0.7493]		
RESET F(1, 53)	0.34316 [0.5605]		

3. Stability

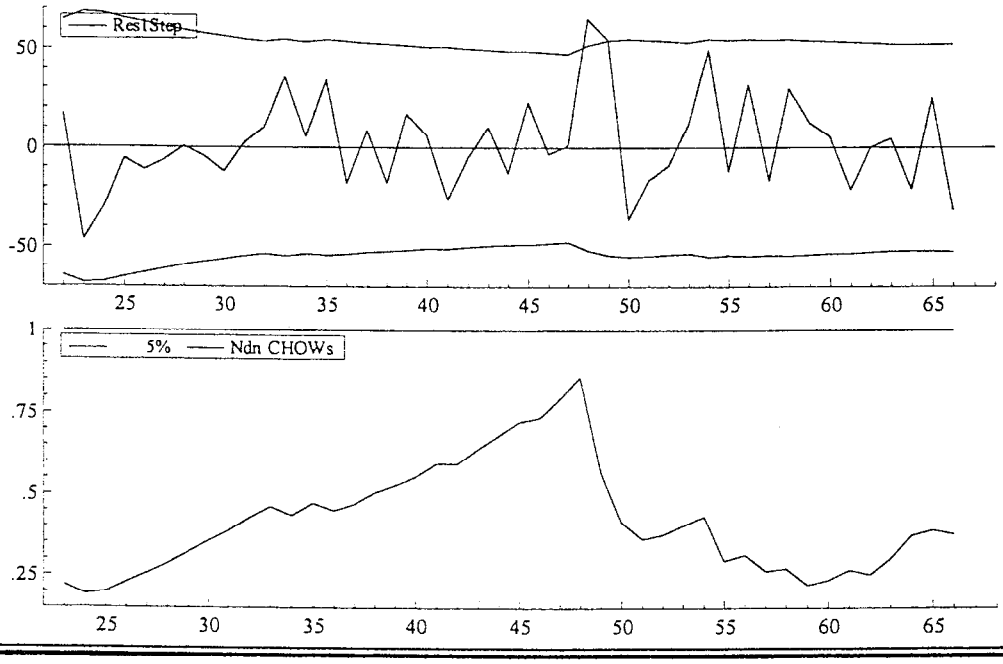
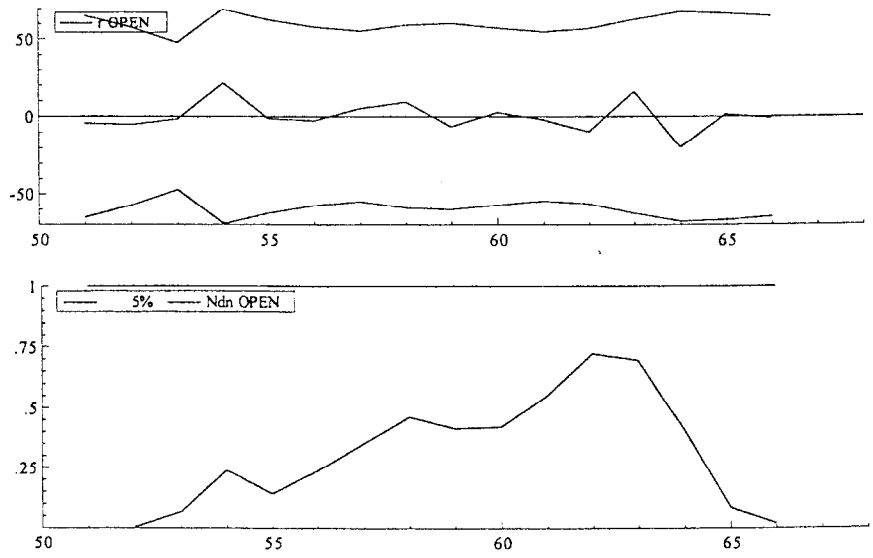


Table A.4. Banking Stability Model Analysis

	Constant	*OPEN*	*SDR*	*TRADE*	*INF*	*LDEP*	*SAV*	Dum97s
1. Full model analysis								
Full model	0.939	-0.007	0.000	0.002	0.000	0.043	-0.027	-
t-stat.	12.061	-1.236	2.980	3.940	1.948	10.697	-11.510	-
Augmented model	0.968	-0.006	0.000	0.002	0.000	0.044	-0.027	-0.102
t-stat.	13.656	-1.110	3.158	4.015	1.769	10.900	-11.633	-1.951

2. Contitonal model analysis							
a/ Cointegration (VAR)							
*H*o:rank=*p*	*T*log(1-*mu*)	using *T-nm*	95%	-*T*\Sum log(.)	using *T-nm*	95%	
p == 0	111.5**	32.13	39.4	207.3**	59.73	94.2	
p <= 1	52.68**	15.18	33.5	95.82**	27.61	68.5	
p <= 2	22.2	6.397	27.1	43.14	12.43	47.2	
p <= 3	14.13	4.07	21	20.94	6.033	29.7	
p <= 4	6.751	1.945	14.1	6.812	1.963	15.4	:
p <= 5	0.061	0.018	3.8	0.061	0.018	3.8	
b/ Weak exogeneity (2 cointegrating vectors)							
LR-test, rank=2: Chi^2(2) = 5.8091 [0.0548]							
c/ Granger causality							
RDEP does not cause *OPEN*	0.59993578	0.6					
OPEN does not cause *RDEP*	0.22539561	0.9					
d/ Stability							



Full model diagnostics		
Full	R^2	0.302
	$F(6,586)$	42.233
		[0.0000]
Augmented	R^2	0.301161
	$F(7,585)$	42.017
		[0.0000]

Memorandum:
t-stat critical values:
Two-sided test, with $n>120$
1-percent significance: $t>2.57$
5-percent significance: $t>1.96$
10-percent significance $t>1.282$

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