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The Evolution of Exchange Rate Regimes Since 1990: Evidence from De Facto Policies

Andrea Bubula and İnci Ötker-Robe

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**The Evolution of Exchange Rate Regimes Since 1990:
Evidence from De Facto Policies**

Prepared by Andrea Bubula and İnci Ötker-Robe[1]

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Abstract

The views expressed in this Working Paper are those of the author(s) and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the author(s) and are published to elicit comments and to further debate.

This paper presents a monthly database on de facto exchange rate regimes that covers all IMF members since 1990. Information from IMF country reports and other sources, including exchange rate data, is utilized to determine de facto exchange rate policies. Countries are categorized based on these policies using the IMF nomenclature adopted in 1999. This approach ensures the forward compatibility of the database. The database is then used to examine whether the "bipolar view" of exchange regimes holds with de facto regimes. It is found that the proportion of countries adopting "intermediate" regimes has indeed been shrinking in favor of greater flexibility or greater fixity, especially for countries more integrated with international markets. Analyses based on Markov chains of regime transitions, however, provide (mixed) evidence against the bipolar view.

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I. INTRODUCTION

The choice of an optimal exchange rate regime is one of the major unresolved questions of international macroeconomics. With "intermediate regimes" having been at the center stage in most major currency crises in recent years, there has been growing support for the so called bipolar view that hard pegs and free floats are the only regimes compatible with the current degree of financial market integration, and that countries with high capital mobility are, or should be, abandoning intermediate regimes between these two extremes.[2][3] The proponents of this view argue that a peg cannot be viable under capital mobility unless the country makes an irrevocable commitment to the peg and is prepared to support it absolutely. The only feasible alternative to such commitment would be to float the currency by putting the country under the discipline of the markets on a continuous basis.

Judging from official notifications by country authorities to the IMF, the evolution of exchange rate regimes since the late 1970s seems to support the bipolar view. Indeed, the proportion of IMF member countries with officially pegged exchange rates has halved, whereas that of floating countries has doubled. Furthermore, within this declining group of pegged regimes, the share of hard pegs increased over the past decade or so, as a growing number of countries adopted currency boards, joined currency unions, or formally dollarized.

A country's actual exchange rate regime, however, can differ from its official notification. Over the past decade or so, a number of countries that had officially declared to be floating were in reality targeting stable exchange rates.[4] Such a divergence has in turn been used to challenge the validity of the bipolar view (for example, Calvo and Reinhart, 2000). A natural question then is

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[2] Intermediate regimes include soft peg regimes (including conventional fixed and crawling pegs and horizontal and crawling bands) and tightly managed floating regimes (where authorities heavily monitor and control exchange rate movements without any commitment to a predetermined target path, but attempt to keep the exchange rate path stable). Hard pegs include regimes with another currency as legal tender, currency unions, and currency boards.

[3] The bipolar view is also referred to as "vanishing or missing middle," "hollowing out of intermediate regimes," or "corner solutions." See Eichengreen (1994) for initial discussions and also Obstfeld and Rogoff (1995), Goldstein (1999), Summers (1999), and Fischer (2001) for related arguments.

[4] Divergences between stated and actual policies could reflect, among other things, concerns about the political cost of undertaking visible devaluations under a formally announced peg, or the "fear of floating" to limit the potential impact of exchange rate depreciation on inflation and balance sheets when there is high degree of dollarization or large exchange rate exposure in the domestic economy (see, for example, Collins, 1996; Baliño, Bennett, and Borensztein, 1999; Calvo and Reinhart, 2000; and Hausmann, Panizza, and Stein, 2000).

whether the bipolar view would still be supported if the analysis is based on de facto exchange rate regimes. Providing an answer to this question requires establishing a comprehensive database of the exchange rate regimes actually pursued by all IMF members.

Characterizing exchange rate policies actually pursued by countries has been one of the greatest challenges to empirical analyses of exchange rate regimes. Most of the previous studies have relied on the former IMF official classification that summarized, from 1975 to 1998, members' exchange regimes based on their official or de jure notifications to the IMF.[5] This classification suffered from many shortcomings. The most important was its failure to capture differences between what the countries claimed to be doing and what they were doing in practice and also to distinguish between very rigid forms of pegged regimes and softer pegs.[6] To address these shortcomings, the IMF adopted a modified system in 1999, distinguishing between various types of pegged regimes and classifying exchange regimes based on countries' de facto policies (see IMF, 1999 for details). This system presents a marked improvement over the former classification. Unfortunately, the lack to date of a historical database has thus far limited its usefulness for empirical analysis.

The first objective of this paper is to construct a monthly database of de facto exchange rate regimes of all IMF members since 1990 using the IMF's current nomenclature adopted in 1999. This nomenclature classifies members' exchange rate regimes along a flexibility spectrum, ranging from regimes with no separate legal tender to currency boards, conventional fixed or crawling pegs, horizontal bands, crawling bands, managed floating with no predetermined path for the exchange rate, and to independently floating rates. The database of this paper also provides refinements on some regime categories, distinguishing backward-looking crawls from forward-looking ones and tightly managed floats from other managed floating regimes. The classifications are based primarily on information obtained through bilateral discussions with or provision of technical assistance to member countries, and from regular contacts with IMF desk economists. The views drawn from these documents are supplemented with press reports, news articles, and other relevant papers, as well as with an analysis of the observed movements in exchange rates.

The second objective of the paper is to use this database to examine the evolution of various exchange rate regimes since 1990, for all IMF membership combined as well as for particular country subgroups. A simple analysis of trends in de facto exchange rate regimes appears to support earlier claims (for example, Fischer, 2001) that, over the past decade, the proportion of countries adopting intermediate regimes has been shrinking in favor of either greater flexibility

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[5] Countries must notify the IMF within 30 days of becoming a member and also promptly following any changes in their regimes (see IMF, 1999).

[6] Holden, Holden, and Suss (1979) were among the first to point out deficiencies in the IMF classification. See also Collins (1996), IMF (1999), Levy-Yeyati and Sturzenegger (1999), Masson (2001), and Poirson (2001) for recent discussions.

or greater fixity. However, the trend away from intermediate regimes is mostly accounted for by developed countries and by emerging markets that are already, or increasingly, integrated with the international financial markets. Intermediate regimes, despite their decline, have continued to be a common practice in many nonemerging market developing countries. The paper also finds that the extent of the decline has not been uniform across different types of intermediate regimes, with a tendency to move from less flexible toward more flexible intermediate regimes.

A more detailed statistical examination of the observed trends is then carried out by estimating Markov transition probabilities between three broad categories: hard pegs, intermediate regimes, and floating regimes. This part of the analysis is related to Masson (2001), who conducted a similar analysis using annual data from two earlier classifications of exchange rate regimes—one that relied partly on the IMF de jure classification (Ghosh, Gulde, Ostry, and Wolf (GGOW), 1997) and another based purely on observed exchange rate and reserves developments (Levy-Yeyati and Sturzenegger, 1999). The findings are consistent with Masson (2001), in that the present paper finds no strong empirical support for the bipolar view (with intermediate regimes likely to be a part of the long-run distribution of exchange rate regimes). Yet, new evidence of structural instability in the data points to the need to obtain additional evidence from the future evolution of exchange rate regimes before concluding against the "vanishing middle" proposition.

The rest of the paper is organized as follows. Section II provides a brief review of the earlier work on classifying exchange rate regimes, describes the methodology of the regime classifications adopted in this paper, and discusses issues involved in classifying exchange rate regimes. Section III discusses the observed trends in members' exchange rate regimes since 1990 to identify if there is any tendency toward declining intermediate regimes. Section IV estimates Markov transition probabilities of shifts among alternative exchange rate regimes to examine the hollowing out hypothesis more formally. Section V concludes.

II. CLASSIFYING COUNTRIES' EXCHANGE RATE REGIMES

A. Background

From 1975 through 1998, the official IMF exchange regime classification system categorized members' exchange rate policies based on their official notifications to the IMF (i) within 30 days of becoming a member and (ii) promptly after any changes in their regimes occurred. Members' regimes were grouped according to their own official statements about the degree of exchange rate flexibility. Specifically, the de jure classification distinguished between three main categories: pegged regimes, regimes with limited flexibility (those that permit the exchange rate to fluctuate within a range or within a cooperative arrangement), and more flexible arrangements, in which the exchange rate is managed or allowed to float freely.

Among the key advantages of the de jure classification were its comprehensiveness in terms of country coverage, frequent updating (on a quarterly basis), and long history, and many empirical analyses of exchange rate regimes have relied on it. However, this system had a

number of well-recognized shortcomings, the most important of which was its failure to capture differences between what the countries claimed to be doing and what they were doing in reality. Some countries with pegged regimes engineered frequent devaluations, using the exchange rate as a safeguard for export competitiveness, thereby making their regime less distinct from a flexible one. Others, claiming to have floating regimes, informally pegged or managed their exchange rates along a predetermined path;[7] these reflected, among other things, attempts to avoid the political costs of visible devaluations if the peg were to be announced, the desire to use the exchange rate as an inflation anchor while avoiding the risk of one-way bets against their currencies, or the "fear of floating" in the presence of large foreign exchange exposures or high degree of dollarization. The resulting divergence between the de jure and de facto regimes reduced the transparency of exchange rate policy, making effective surveillance over members' policies difficult and clouding the policy implications derived from research and policy work using this classification.[8] A second weakness of the system was that, by lumping rigid forms of pegs together with softer pegs, it failed to acknowledge the different degree of monetary autonomy afforded by each regime.

With a view to addressing these shortcomings, the IMF adopted a new classification scheme based on de facto policies, which has become official since January 1999. The new system has also distinguished between various types of pegged regimes to reflect varying degrees of monetary autonomy and commitment to a given exchange rate path. After an extensive examination of the nature of various practices followed by members and also guided by the existing literature on the variety of exchange rate regimes, the following categories were identified: (1) regimes with no separate legal tender—including regimes with another currency as legal tender (formal dollarization) and currency unions; (2) currency boards; (3) conventional fixed pegs (against a single currency or a basket of currencies); (4) pegged exchange rates within horizontal bands; (5) crawling pegs; (6) crawling bands; (7) managed floating with no predetermined path for exchange rate; and (8) independently floating.

While this new scheme is a marked improvement over the former classification, the lack of a historical database has limited its usefulness for empirical analysis. In the absence of such a database, for example, a number of researchers relied on the observation of a few data points available on the new classification in their analysis of exchange rate regimes.[9] This in turn provided the main motivation for the present paper, namely to construct a historical database on de facto regimes for all member countries that extends the current classification back in time,

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[7] Close to 60 percent of the countries classified as managed floaters at the end of 1997 maintained some form of de facto peg regimes (15 percent conventional fixed pegs, 13 percent crawling pegs, 20 percent crawling bands, and 11 percent horizontal bands). See IMF (1999).

[8] Accounting for members' de facto policies indicated, for example, that exchange rate anchors remained as the predominant monetary arrangement at end-1997.

[9] See, for example, Fischer (2001), Glick (2000), and Poirson (2001).

from end-2001 to the beginning of 1990. Constructing such a database maintains the main advantage of the old classification in that it covers all member countries and is consistent with the IMF's new official classification, which will continue to be updated as long as the new nomenclature remains in place.[10] Those advantages differentiate the present paper from several other attempts at identifying differences between de facto and de jure regimes, which are discussed below.

In a comprehensive study of the macroeconomic performance of different exchange rate regimes during the period 1960–90 for about 140 countries, GGOW (1995, 1997) combine the IMF de jure classification with the actual exchange rate behavior so as to differentiate between official and actual policies. The authors supplement the stated intentions of the central bank, as suggested by the de jure classification, by categorizing the pegged regimes according to whether or not changes in parity have been frequent or infrequent, and distinguish between countries with heavy or no intervention, based on a survey of IMF desk officers for the countries in the sample. The authors propose a very fine taxonomy of regimes (about 25 categories), grouped under nine more-aggregated categories: single currency pegs, SDR pegs, other published basket pegs, secret basket pegs, cooperative systems, unclassified floats, floats within a predetermined range, floats without a predetermined range, and pure floats. The information content of the classification contributed partly to the selection of the nomenclature behind the current IMF classification back in 1997. The regime classifications specified, however, also do not distinguish between soft pegs and the hardest forms of peg commitments, and some countries are placed in unclassified categories.[11] Post-1990 updates are also not automatic in that they require processing of the relevant raw data.[12]

In contrast to both GGOW (1995, 1997) and the present paper, Levy-Yeyati and Sturzenegger (1999) ignore the IMF's old official classification altogether. Their analysis, based on an original framework from Holden, Holden, and Suss (1979) instead, provides an alternative classification over the period from 1990–98 that aims to capture actual exchange rate policies

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[10] Note, however, that in the overlapping years from 1999 (the year in which the new classification system became official), the classifications in this paper's database diverge in a number of instances from the official classifications published in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*, owing to the additional information assembled during this research. The paper also adds to the IMF official classification more details on some regimes (e.g., introducing backward- and forward-looking crawling pegs and bands, and tightly managed floats).

[11] In further research on the topic, Ghosh, Gulde, and Wolf (2000) and Ghosh, Gulde and Wolf (forthcoming), address the distinction between de jure pegs and hard pegs, and perform robustness tests explicitly addressing the issue of "soft pegs" and "hard floats."

[12] The data have been updated up to 1999. Masson (2001) uses an earlier update to 1997 for an analysis of regime transitions.

on the sole basis of the observed behavior of official exchange rates and international reserves, with the latter presumed to measure the extent of foreign exchange intervention.[13] Exchange rate regimes are classified into four main categories (flexible, dirty float, crawling peg, and fixed) by using cluster analysis of the monthly percentage changes in the nominal exchange rate, the relative volatility of exchange rate levels, and the volatility of reserves.[14] Countries without significant variability in either variable are included in the "inconclusive" group.[15] While such a classification has some conceptual attractiveness for some purposes, it has some limitations as discussed below. The classification also covers only a subset of 110 IMF member countries for which the relevant exchange rate and reserve data are available and leaves a number of countries in the inconclusive category.[16]

In a contemporaneous paper, Reinhart and Rogoff (2002) present a monthly database of exchange rate regimes for 153 countries over the period 1946–2001. The authors recognize the merits of the new IMF classification and adopt a broadly similar nomenclature to classify the regimes.[17] Exchange rate regimes are classified and verified mainly by applying a variety of

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[13] Several other studies used this approach to study the choice or behavior of exchange regimes. These include: Baig (2001), Bofinger and Wollmerhäuser (2001), Calvo and Reinhart (2000a and 2000b), Hausmann, Panizza, and Stein (2001), and Poirson (2001).

[14] Countries with high exchange rate volatility and low reserve volatility are mapped into the flexible category. Those with a low variation in the exchange rate data but high volatility in reserves are classified as fixers, presuming that monetary authorities were intervening to offset market forces. Countries with relatively high volatility across all variables are classified as dirty floaters, while those with significant but relatively stable exchange rate variations and active foreign exchange intervention are identified with a crawling peg.

[15] For example, Belgium and France with horizontal bands in IMF classification were included in the "inconclusive" group together with Argentina with a currency board, Nepal with a conventional fixed peg, and several countries with currency unions. Other countries with similar regimes (for example, Hong Kong SAR with a currency board, other members of currency unions, and several countries participating in the European Union's exchange rate mechanism (ERM)) were classified in the "fixed" category.

[16] An additional feature of the paper's methodology is its reliance on cluster analysis, which sorts countries into a given number of groups according to the characteristics of the three variables of reference. The regime classifications generated by this approach are not robust to the choice of the number of countries in the sample and the number of clusters specified ex-ante by the user. The lack of such robustness is an important limitation for a methodology to classify exchange regimes for the whole membership that may change over time.

[17] The main exception is the introduction of an additional category of "freely falling" rates when monthly inflation exceeds 50 percent and when there is no official announcement of the regime by the authorities.

descriptive statistics to either official or market-determined parallel exchange rates, depending on whether a given country has unified or multiple exchange rates. The frequency and the length of the database, as well as the application of a systematic approach to classifying regimes, are its main advantages. While the database is quite comprehensive, the lack of full availability of (official or parallel market) exchange rates tends to limit the country coverage. Furthermore, updating the database beyond 2001 requires processing of the raw data as well as classifying some exchange rate regimes based mainly on actual exchange rate movements, which, as discussed below, presents some potential limitations.

B. The Approach of this Paper

Classifications based solely on the behavior of exchange rates and reserves have limitations in terms of country coverage, in view of the limited availability of relevant exchange rate and official reserves data for all countries. More important, sole reliance on such data may in many cases lead to incorrect inference about the actual exchange rate regime. First, exchange rate stability could be the outcome of stable fundamentals or lack of significant shocks to the economy. Since many different aspects of economic policy have an effect on the exchange rate, it is difficult to disentangle the actions aimed at stabilizing the exchange rate from those directed at other goals (for example, direct inflation targeting). A high sample variance may also be due to a one-time large devaluation under a pegged exchange regime and thus may not indicate greater exchange rate flexibility.[18] Differences in the size and depth of foreign exchange markets may also affect exchange rate volatility. Moreover, statistical analysis of official exchange rates would be misleading if the country maintains multiple exchange rates and the reported official rate affects only a fraction of the foreign exchange transactions, while remaining transactions are effected at officially recognized market-determined rates.[19]

Supplementing the exchange rate with official reserves data does not entirely solve the drawbacks of focusing on quantitative measures alone. Changes in reserves may, for instance, be linked to debt or reserve management strategies, and not necessarily to an exchange rate stabilization motive. Reserve data could be distorted by valuation changes and official borrowing or repayments; no allowance is made for intervention by other countries that may negate the need for exchange market action by the country under consideration; and there may not be a linear relationship between changes in exchange rates and reserves (see Holden,

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[18] Reinhart and Rogoff (2002) use mean absolute deviations to minimize the impact of such outliers.

[19] Using movements in the exchange rates prevailing in the parallel markets that are not officially recognized or tolerated would be misleading in inferring about the actual exchange rate regime pursued by the authorities. The use of such rates would also be misleading when the parallel market is shallow and is primarily used for illicit transactions, with the discount between the official and the parallel market rates simply reflecting transaction costs involved in conducting such activities.

Holden, and Suss, 1979). In addition, the extent of intervention may be concealed if currencies are defended through intervention through swaps and forwards. Even more important, the authorities may affect the exchange rate without any direct purchase or sale of foreign exchange in the market. For example, in less-developed economies with small and shallow foreign exchange markets, indirect intervention may take the form of administrative foreign exchange controls and regulations or "moral suasion,"[20] all of which attempt to limit the ability of market forces to set the exchange rate freely.

Given the limitations associated with a classification based purely on quantitative analysis, this paper uses a combination of quantitative and qualitative analysis in constructing the database on de facto regimes—an approach which coincides with that pursued by the current official IMF classification. The primary source in identifying the de facto policies is the information obtained through bilateral consultation discussions with and provision of technical assistance to member countries, and regular contacts with IMF country desk economists. These views are then supplemented with other sources of information, including press reports, news articles, and other relevant papers, and supported by an analysis of observed exchange rate and reserves behavior, to reach a final view on the de facto regime.

Assessing what countries actually do with their exchange rate policy is clearly a complicated task, except in the case of hard peg regimes, where the authorities are forced by their legal commitment to implement the de jure regime. The task is particularly difficult where countries officially announcing (managed or independently) floating regimes use systematic direct (through sale or purchase of foreign exchange by the central bank or its agents) or indirect intervention (through foreign exchange regulations or moral suasion) to target informally the exchange rate. The approach taken to identify these cases has been to supplement data on exchange rates and reserves with evidence contained in various documents to identify whether or not authorities were pursuing informal targets. The following guidelines were applied in assigning to countries the specific regime categories:

- Exchange rate stability by itself was not sufficient to classify a given regime as a peg, unless documents from a variety of sources provided evidence that the authorities formally or informally sought to keep the exchange rate stable vis-à-vis a given currency or a basket of currencies. When available information indicated that the authorities targeted to keep the exchange rate stable and the exchange rate remained within a range less than 2 percent for at least four months vis-à-vis a given currency, the regime was classified de facto as a conventional fixed peg.

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[20] With the threat of a more severe supervision or loss of licenses, banks may refrain from transacting at rates different from those perceived as preferred by the authorities. Foreign exchange may be allocated through auctions in which authorities may control the price process by requesting the bids before deciding the amount to sell or by putting limits on the bids that could be submitted. State-owned banks and corporations may be forced to comply with implicit directives to stabilize the rate.

- Basket pegs are more difficult to verify, particularly when the composition of baskets and/or weights are undisclosed. Aside from the unambiguous cases where authorities were clearly not following the announced policy (e.g., when the relevant currency stayed constant vis-à-vis another currency—e.g., the U.S. dollar for Bangladesh, or the Indian rupee for Nepal), the de jure classification of basket pegs was maintained.

- Countries were assigned crawling peg regimes (with or without bands) when there was evidence in documents (supported by nominal and real exchange rate data) of a formal announcement or an informal pursuit of a policy of gradual depreciation of the currency by small amounts with or without a formal or unannounced band, according to a formula. Distinction was made between forward- and backward-looking crawling pegs and bands to indicate differing degrees of commitment to a given exchange rate path and role of the exchange rate as a nominal anchor. Information contained in the documents was used to make this distinction.

- Countries were also classified as pursuing a (fixed or crawling) peg regime when they announced a band regime, but limited exchange rate movements through heavy intramarginal intervention within narrow inner bands (e.g., Belarus, Brazil, and Russia).

- A regime was classified as a managed float rather than a peg, when the officially announced regime was a fixed peg, but the official rate was subject to frequent devaluations within very short time periods (e.g., as in Bangladesh during 1995–97), or when the country maintained multiple exchange rates and the majority of transactions were effected at a more market-based (official or officially recognized secondary) rate, rather than at the fixed official rate (e.g., Myanmar and Nigeria since 1995). As a general rule, when countries maintained multiple exchange rates, the classification of the regime was based on the determination of the exchange rate that applied to most transactions.

- In choosing between managed and independently floating regimes, the decisive factor was the presence of some evidence that direct or indirect intervention was aimed at countering the long-term trend of the exchange rate beyond what is warranted to prevent excessive exchange rate volatility. In tightly managed floats, authorities have been considered to be aiming at a stable exchange rate path by closely monitoring and controlling the exchange rate, where such stability could not be clearly identified as distinct episodes of a peg, a crawl, or a band (e.g., Paraguay and Singapore).[21]

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[21] In Paraguay, the overall policy throughout the 1990s was to maintain an "adjustable peg" vis-à-vis the U.S. dollar with monetary policy geared toward keeping the exchange rate under control. The authorities intervened broadly to maintain the real effective value of the currency, achieved mainly through relatively short periods of frequent adjustment of the nominal rate, followed by more stable exchange rates, and occasional step adjustments in the exchange rate. Singapore has operated an undisclosed "monitoring band" system—a variant of the "basket, band, and crawl" regime referred to by Williamson (2000b). The authorities manage the

This approach of classifying exchange rate regimes offers many advantages over an approach based solely on quantitative analysis. However, its heavy reliance on the quality of available information may introduce some margin of uncertainty where the authorities may be reluctant to make actual policies publicly known, and when such reluctance influences the coverage of documents in providing a more candid description of the actual regime. There is also an element of judgment in interpreting the information contained in a particular way. Nevertheless, using the same set of criteria and a variety of information sources in forming a judgment about the nature of the exchange rate regimes for all members limits the risk of misplacing a country's regime relative to the other countries within the membership.

The database covers the period from January 1990 to December 2001. Diagram 1 presents the 13 categories, after distinguishing between forward- and backward-looking crawling pegs and bands and between tightly and other managed floating with no predetermined path for the exchange rate. Box 1 describes each category. For the following analysis of the bipolar view of exchange rate regimes, we define categories (1)–(3) as "hard pegs," (4)–(11) as "intermediate regimes" (i.e., consisting of tightly managed floats and "soft pegs" such as conventional fixed and crawling pegs and horizontal and crawling bands), and (12)–(13) as "floating regimes." The classifications for all IMF members from 1990 to 2001 are provided in Appendix I on an end-year basis.[22]

III. The Evolution of Exchange Rate Regimes Since 1990

Table 1 shows the evolution of various aggregated regime categories over 1990–2001 based on countries' de facto policies (Appendix II provides the evolution of more disaggregated categories). Despite a marked decline in their share, various forms of pegged regimes have remained the relatively more dominant type of monetary arrangement among the IMF members, in contrast to what is suggested by the de jure system (Table 2). As of end-2001, more than half of the member countries (56 percent) were still pursuing various forms of pegged arrangements, compared with the 80 percent at the beginning of the 1990s. There has been a discernible shift in the composition of pegged regimes during this period, however, away from soft peg regimes to harder pegs, with the latter more than doubling their share (Figure 1).

Singapore dollar against a basket of currencies of the main trading partners, allowing it to float within a target band around a central parity; both the central parity and the band width are undisclosed, reviewed and adjusted periodically to ensure consistency with economic fundamentals and market conditions, with no obligation to defend the edges of the band (see Eichengreen, 2001; Rajan and Siregar, 2000; and MAS, 2000 and 2001).

[22] Regime classifications at monthly frequency are available from the authors upon request.

Diagram 1. De Facto Classification of Exchange Rate Regimes
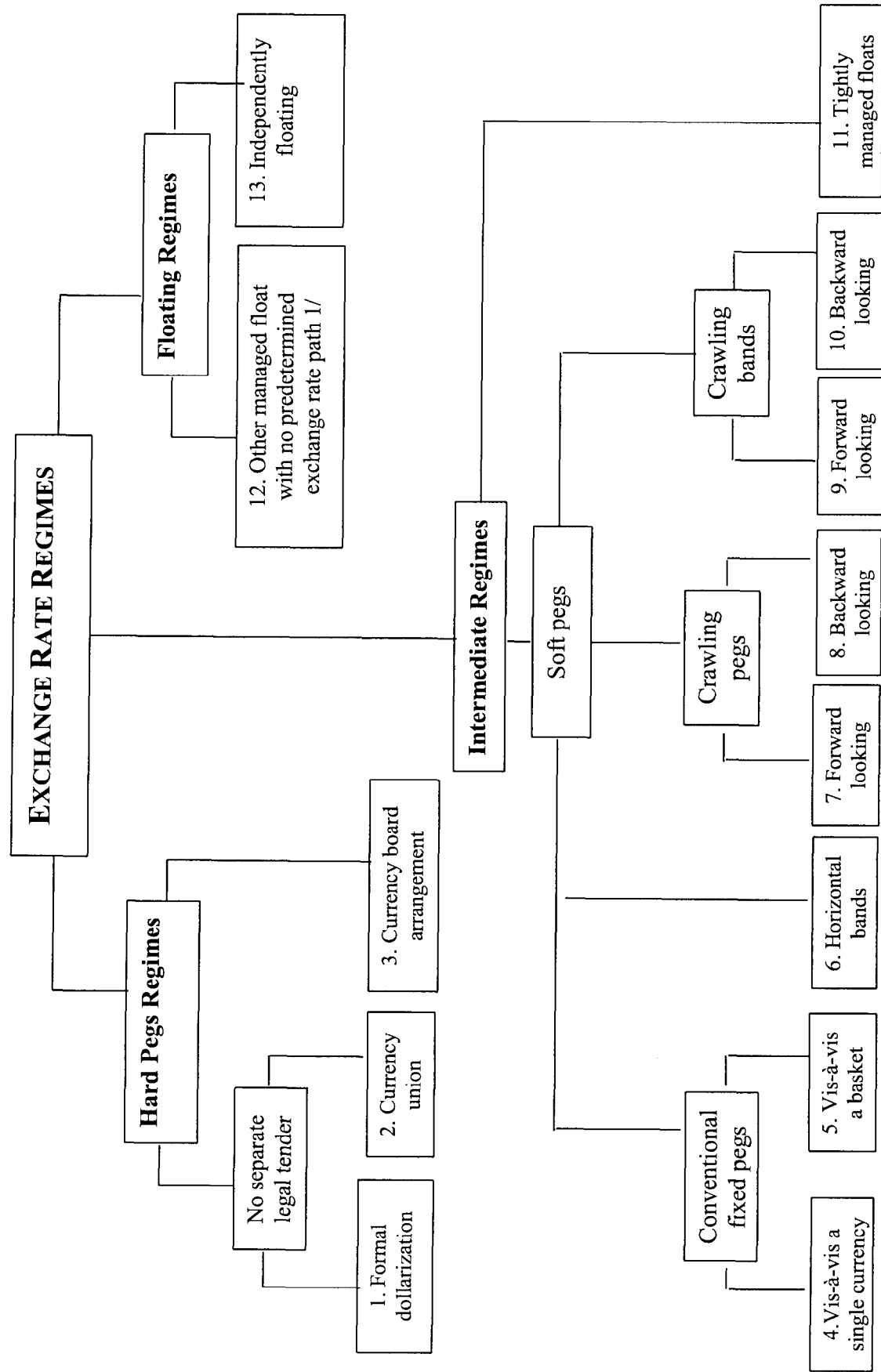
1/ Excludes tightly managed floats.

Box 1. Classification of Exchange Rate Regimes

Exchange Regimes with Another Currency as Legal Tender (Formal "Dollarization")

The country uses the currency of another country, which circulates as the sole legal tender. Dollarization is a complete surrender of the authorities' independent control over domestic monetary policy, and as such, can be viewed as the hardest form of a pegged regime.

Exchange Regimes with No Separate Legal Tender (Currency Unions)

The member belongs to a monetary or currency union in which they share the same legal tender. By adopting such regimes the authorities also surrender control over domestic monetary policy and, hence, such regimes are also viewed as a hard exchange rate peg.

Currency Board Arrangements (CBAs)

An exchange rate regime based on an explicit legislative commitment to exchange domestic currency for a specified foreign currency at a fixed exchange rate, combined with restrictions on the issuing authority to ensure the fulfillment of its legal obligation. This implies that domestic currency remain fully backed by foreign assets, eliminating traditional central bank functions such as monetary control and lender of last resort. While leaving little scope for discretionary monetary policy, some flexibility may be afforded depending on the strictness of the board's rules.

Conventional Fixed Peg Arrangements: Vis-à-Vis a Single Currency or a Currency Composite

The country (formally or de facto) pegs its currency at a fixed rate to another currency or a basket of currencies, where a basket is formed from the currencies of major trading or financial partners and weights reflect the geographical distribution of trade, services, or capital flows. The currency composites can also be standardized, such as that of the SDR. There is no commitment to keep the parity irrevocably. The exchange rate may fluctuate within a narrow margin of less than ±1 percent around a central rate or the maximum and minimum value of the exchange rate remains within a narrow margin of 2 percent for at least three months. The authorities stand ready to keep the fixed parity through direct (i.e., via sale/purchase of foreign exchange in the market) or indirect intervention (e.g., via aggressive use of interest rate policy, imposition of foreign exchange regulations or exercise of moral suasion that constrain foreign exchange activity, or through intervention by other public institutions). Flexibility of monetary policy, though limited, is greater than in hard pegs, as traditional central banking functions are still possible, and the authorities can adjust the level of the exchange rate, though relatively infrequently.

Crawling Pegs: Forward and Backward Looking

The currency is adjusted periodically vis-à-vis a single currency or a basket in small amounts at a fixed rate or in response to changes in selective quantitative indicators (past inflation differentials with major trading partners, differentials between the targeted or projected inflation with major trading partners, differentials between official and parallel market rates, etc.). Distinction is made between backward- and forward-looking crawls: the crawl is viewed as "backward looking" when the crawl is set to generate inflation adjusted changes in the currency (i.e., when it aims to passively accommodate past inflation differentials under a real exchange rate rule); and as "forward looking" when the exchange rate is adjusted at a preannounced fixed rate and/or set below projected inflation differentials, typically when the exchange rate is envisaged to have an anchor role. Maintaining a credible crawling peg imposes similar constraints on monetary policy as a fixed peg system, particularly in a forward-looking crawl, as the authorities are expected to intervene to ensure the targeted fixed depreciation path. The degree of intervention in a backward-looking crawl is expected to be less given the lack of commitment to a fixed depreciation path and the absence of a need to anchor expectations.

Pegged Exchange Rates Within a Horizontal Band

The currency is allowed to move within margins of fluctuation of at least ±1 percent around a formal or a de facto fixed central rate. The authorities stand ready to defend the limits of the band through direct or indirect intervention to maintain the exchange rate within these limits. Some limited degree of monetary policy discretion can be afforded, with the degree of discretion depending on the band width.

Pegged Exchange Rates Within Crawling Bands: Forward and Backward Looking

The currency is maintained within fluctuation margins of at least ±1 percent around a formal or a de facto central rate, which is adjusted periodically in small amounts at a fixed rate, or in response to changes in selective quantitative indicators. A similar distinction is made between backward- and forward-looking crawls. The degree of exchange rate flexibility is a function of the band width; bands can be chosen to be either symmetric or fixed around a crawling parity or to widen gradually with an asymmetric choice of the crawl of upper and lower bands (in the latter case, there may not be a preannounced central rate). The commitment to maintain the exchange rate within the band continues to impose constraints on monetary policy, with the degree of policy independence a function of the bandwidth.

Tightly or Other Managed Floating with No Predetermined Path for the Exchange Rate

The authorities influence exchange rate movements through active intervention to counter the long-term trend of the exchange rate, without specifying a predetermined exchange rate path, or without having a specific exchange rate target ("dirty floats"). Intervention may be direct or indirect. Indicators for managing the rate are broadly judgmental (e.g., balance of payments position, international reserves, parallel market developments), and adjustments may not be automatic. Distinction is made between "tightly managed floating" (where intervention takes the form of very tight monitoring that generally results in a stable exchange rate without having a clear exchange rate path, so as to permit the authorities an extra degree of flexibility in deciding the tactics to achieve a desired path) and "other managed floating" (where the exchange rate is influenced in a more ad hoc fashion).

Independently Floating

The exchange rate is market determined; any foreign exchange intervention aims at moderating the rate of change and preventing undue fluctuations in the exchange rate that are not justified by economic fundamentals, rather than at establishing a level for the exchange rate. In these regimes, monetary policy is in principle independent of exchange rate policy.

Table 1. Evolution of Exchange Rate Regimes by Country Group
(In percent of members in the given category)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Whole membership												
Hard pegs 1/	15.7	16.1	19.4	15.9	16.2	16.2	16.2	18.3	18.3	24.2	24.7	25.8
Intermediate regimes 2/	69.2	66.5	56.1	58.8	56.8	58.9	58.4	53.2	48.9	40.9	41.4	38.7
Of which: soft pegs 3/	64.2	60.2	50.0	52.7	48.1	49.2	50.3	48.4	45.7	35.5	33.9	30.1
Floating regimes 4/	15.1	17.4	24.4	25.3	27.0	24.9	25.4	28.5	32.8	34.9	33.9	35.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Developed countries												
Hard pegs 1/	0.0	0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	50.0	50.0	54.2
Intermediate regimes 2/	73.9	73.9	50.0	54.2	54.2	54.2	62.5	58.3	58.3	12.5	12.5	4.2
Of which: soft pegs 3/	73.9	73.9	50.0	50.0	50.0	50.0	58.3	58.3	58.3	12.5	12.5	4.2
Floating regimes 4/	26.1	26.1	45.8	41.7	41.7	41.7	33.3	37.5	37.5	37.5	37.5	41.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Developing countries												
Hard pegs 1/	18.4	18.8	21.8	17.7	18.0	18.0	18.0	20.4	20.4	20.4	21.0	21.6
Intermediate regimes 2/	68.4	65.2	57.1	59.5	57.1	59.6	57.8	52.5	47.5	45.1	45.7	43.8
Of which: soft pegs 3/	62.5	58.0	50.0	53.2	47.8	49.1	49.1	46.9	43.8	38.9	37.0	34.0
Floating regimes 4/	13.2	15.9	21.2	22.8	24.8	22.4	24.2	27.2	32.1	34.6	33.3	34.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Emerging market countries 5/												
Hard pegs 1/	6.7	10.0	9.7	9.4	9.4	9.4	9.4	12.5	12.5	12.5	15.6	15.6
Intermediate regimes 2/	76.7	66.7	64.5	75.0	68.8	81.3	78.1	56.3	53.1	40.6	37.5	34.4
Of which: soft pegs 3/	63.3	53.3	51.6	62.5	53.1	59.4	62.5	50.0	46.9	34.4	28.1	25.0
Floating regimes 4/	16.7	23.3	25.8	15.6	21.9	9.4	12.5	31.3	34.4	46.9	46.9	50.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Developed and emerging market countries												
Hard pegs 1/	3.8	5.7	7.3	7.1	7.1	7.1	7.1	8.9	8.9	28.6	30.4	32.1
Intermediate regimes 2/	75.5	69.8	58.2	66.1	62.5	69.6	71.4	57.1	55.4	28.6	26.8	21.4
Of which: soft pegs 3/	67.9	62.3	50.9	57.1	51.8	55.4	60.7	53.6	51.8	25.0	21.4	16.1
Floating regimes 4/	20.8	24.5	34.5	26.8	30.4	23.2	21.4	33.9	35.7	42.9	42.9	46.4
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Non-emerging market developing countries												
Hard pegs 1/	21.7	21.3	24.8	19.8	20.2	20.2	20.2	22.3	22.3	22.3	22.3	23.1
Intermediate regimes 2/	66.0	64.8	55.2	55.6	54.3	54.3	52.7	51.5	46.2	46.2	47.7	46.2
Of which: soft pegs 3/	62.3	59.3	49.6	50.8	46.5	46.5	45.7	46.2	43.1	40.0	39.2	36.2
Floating regimes 4/	12.3	13.9	20.0	24.6	25.6	25.6	27.1	26.2	31.5	31.5	30.0	30.8
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Authors' estimates.

1/ Comprises arrangements with another currency as legal tender (i.e., dollarization), currency unions, and currency boards.

2/ Comprises soft pegs plus tightly managed floating regimes.

3/ Comprises conventional fixed pegs vis-à-vis a single currency or a basket, horizontal bands, and crawling pegs and crawling bands.

4/ Comprises independently floating regimes and managed floating with no predetermined exchange rate path, excluding tightly managed floats.

5/ Includes 32 countries or regions: Argentina, Brazil, Bulgaria, Chile, China, Colombia, the Czech Republic, Egypt, Ecuador, Hong Kong SAR, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Panama, Peru, the Philippines, Poland, Russia, Singapore, South Africa, Sri Lanka, Thailand, Turkey, and Venezuela.

Table 2. Evolution of Exchange Rate Regimes
(In percent of IMF membership)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
De Jure Classification 1/												
Pegged regimes 2/	65.4	61.3	58.1	49.1	47.2	44.4	45.3	45.1	44.5	...	...	...
Of which: limited flexibility	9.2	9.0	7.8	7.4	7.9	7.8	8.8	8.8	9.3	...	...	...
Floating regimes	34.6	38.7	41.9	50.9	52.8	55.6	54.7	54.9	55.5	...	...	...
Independently floating	16.3	18.1	26.3	32.0	32.6	30.0	28.7	25.3	24.7	...	...	...
Managed floating	18.3	20.6	15.6	18.9	20.2	25.6	26.0	29.7	30.8	...	...	...
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	...	...	...
De Facto Classification												
Pegged regimes	79.9	76.4	69.4	68.7	64.3	65.4	66.5	66.7	64.0	59.7	58.6	55.9
Hard pegs 3/	15.7	16.1	19.4	15.9	16.2	16.2	16.2	18.3	18.3	24.2	24.7	25.8
Soft pegs 4/	64.2	60.2	50.0	52.7	48.1	49.2	50.3	48.4	45.7	35.5	33.9	30.1
Floating regimes	20.1	23.6	30.6	31.3	35.7	34.6	33.5	33.3	36.0	40.3	41.4	44.1
Independently floating	5.7	7.5	12.8	13.7	13.0	14.1	12.4	14.5	16.7	18.3	19.4	21.5
Managed floating 5/	14.5	16.1	17.8	17.6	22.7	20.5	21.1	18.8	19.4	22.0	22.0	22.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Memorandum item:												
Intermediate regimes 6/	69.2	66.5	56.1	58.8	56.8	58.9	58.4	53.2	48.9	40.9	41.4	38.7

Sources: IMF, Annual Report on Exchange Arrangements and Exchange Restrictions, various issues; and authors' estimates.

1/ Since September 1998, the de jure classification has not been updated.
2/ Includes arrangements with no separate legal tender, currency boards, conventional fixed pegs and horizontal bands, and regimes with limited flexibility within a band and ERM.
3/ Comprises arrangements with another currency as legal tender (i.e., dollarization), currency unions, and currency boards.
4/ Comprises conventional fixed pegs vis-à-vis a single currency or a basket, horizontal bands, and crawling pegs and bands.
5/ Includes tightly managed floating regimes.
6/ Defined as to include tightly managed floating regimes and soft peg regimes.

Figure 1. IMF Membership: The Evolution of Pegged Exchange Rate Regimes, 1990 and 2001
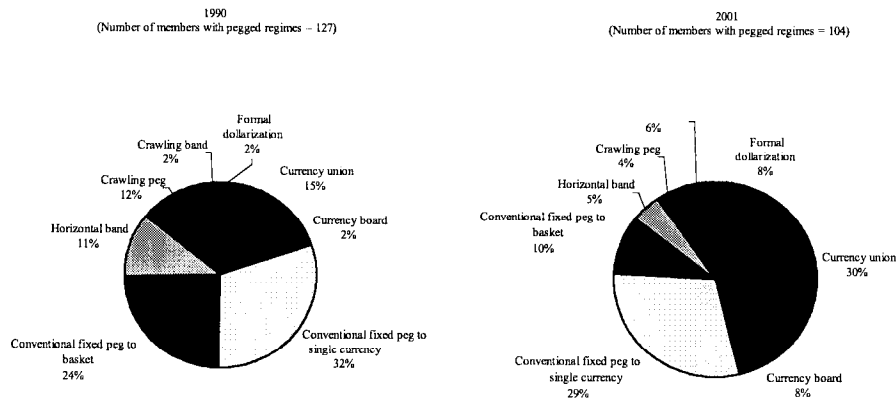
Source: Authors' calculations.

Together with the significant growth in the number of floating regimes, the trend toward harder pegs implies a shift away from intermediate regimes toward the two ends of the spectrum of exchange rate regimes, providing some support for the bipolar view of exchange rate regimes (Figure 2). The share of intermediate regimes dropped by about 30 percentage points over the past decade, with a 10 percent and 20 percent increase in the share of hard pegs and floating regimes, respectively. Exits from intermediate regimes since 1990 indicate that most intermediate regimes exited to a floating regime rather than to hard pegs, although certain intermediate regimes (for example, backward- and forward-looking crawling pegs and backward-looking crawling bands) were replaced by other intermediate regimes before eventually exiting to floating regimes (Figure 3).

Figure 2. Evolution of Exchange Rate Regimes, 1990–2001
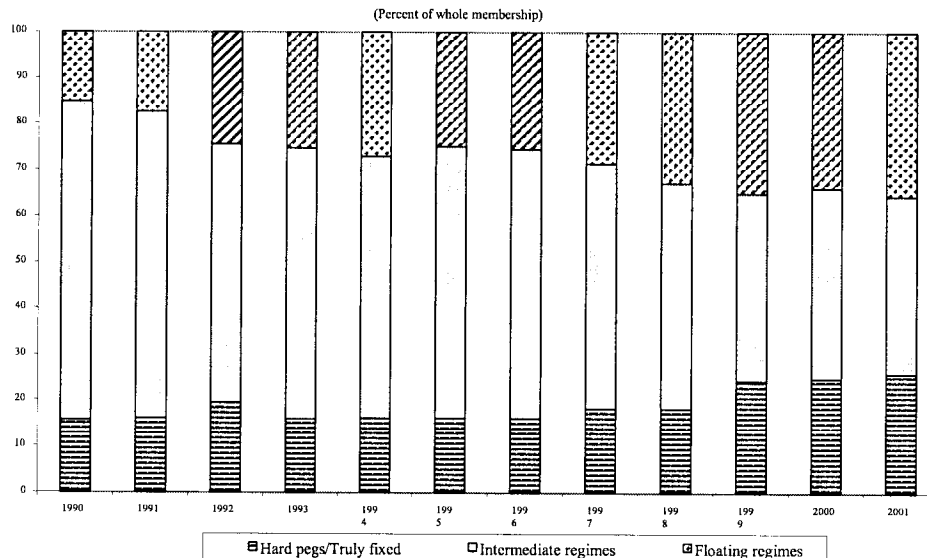
Source: Authors' calculations.

Figure 3. Exits from Intermediate Regimes, 1990–2001
(In percent of all exits within each group)

Aggregated Intermediate Regimes Category

Disaggregated Regime Categories, All Countries
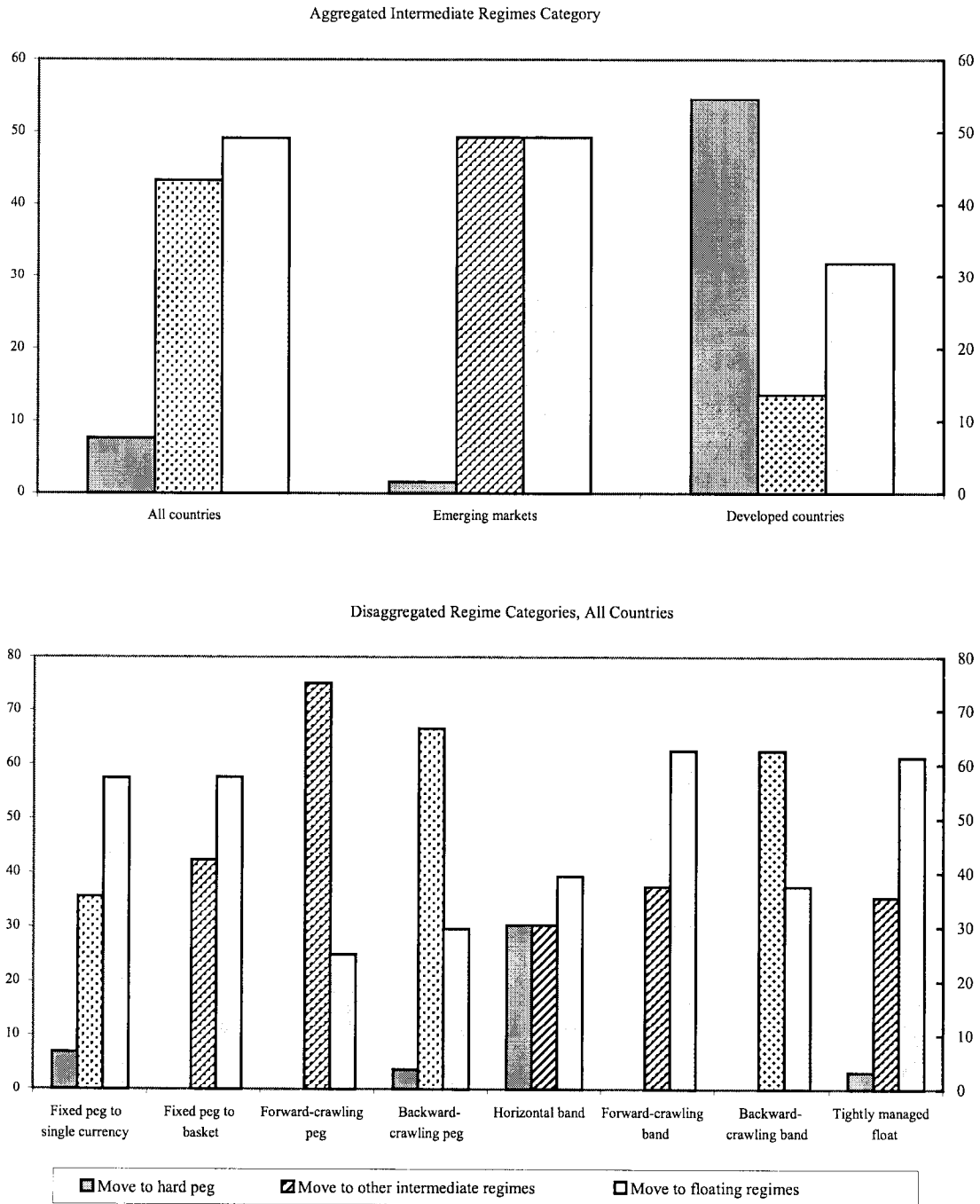
Source: Authors' calculations.

While intermediate regimes have been shrinking, the extent of the decline has not been uniform across different types of intermediate regimes (Table 3 and Figure 4). Many countries abandoned soft peg regimes, but others have continued to hold on to exchange rate targets by

Table 3. The Evolution of Intermediate Exchange Rate Regimes
(In percent of all intermediate regimes, end-year)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Conventional fixed pegs	63.6	58.9	60.4	57.0	53.3	51.4	47.2	51.5	52.7	59.2	57.1	56.9
Fixed peg to single currency	35.5	32.7	33.7	33.6	35.2	36.7	34.3	38.4	40.7	46.1	44.2	43.1
Fixed peg to basket	28.2	26.2	26.7	23.4	18.1	14.7	13.0	13.1	12.1	13.2	13.0	13.9
Horizontal band	12.7	12.1	10.9	12.1	14.3	11.9	16.7	16.2	17.6	6.6	7.8	6.9
Crawling peg	13.6	14.0	12.9	15.0	11.4	11.0	11.1	13.1	12.1	11.8	9.1	5.6
Crawling band	2.7	5.6	5.0	5.6	5.7	9.2	11.1	10.1	11.0	9.2	7.8	8.3
Tightly managed float	7.3	9.3	10.9	10.3	15.2	16.5	13.9	9.1	6.6	13.2	18.2	22.2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Memorandum items:												
Members with intermediate regimes	110	107	101	107	105	109	108	99	91	76	77	72
(in percent of total membership)	69.2	66.5	56.1	58.8	56.8	58.9	58.4	53.2	48.9	40.9	41.4	38.7
Total membership	159	161	180	182	185	185	185	186	186	186	186	186

Source: Authors' estimates.

Figure 4. IMF Membership: The Evolution of Intermediate Regimes Between 1990 and 2001
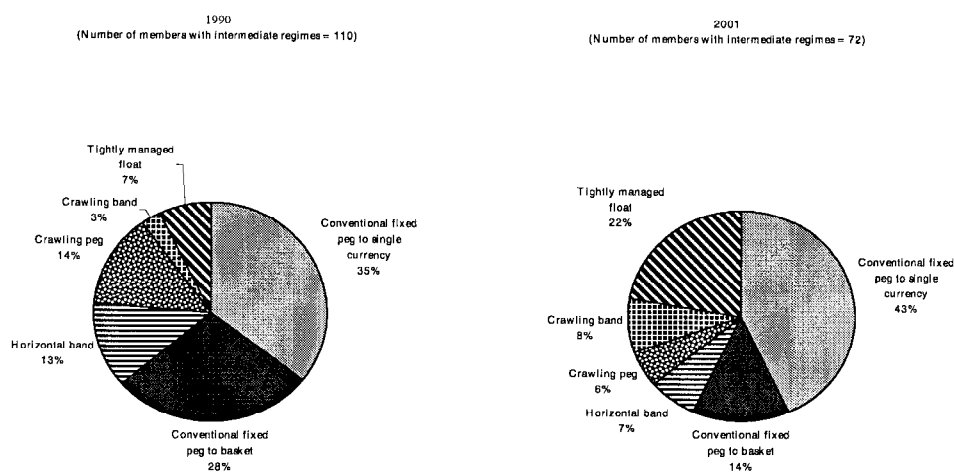
Source: Authors' calculations.

adopting more flexible forms of intermediate regimes.[23] The shares of crawling bands and tightly managed floats in particular have risen, while those of horizontal bands, crawling pegs, and conventional fixed pegs have declined (the latter reflecting the sharp drop in basket pegs). In many cases, the emergence of tensions between the goals of disinflation and competitiveness has been an important factor in abandoning, willingly or unwillingly, the less flexible intermediate regimes toward more flexible ones.[24] Crawling pegs, which had once been very popular among high-inflation countries, were abandoned during crises or made more flexible with the introduction of a band.[25] Crawling bands offered greater flexibility in coping with capital flows and in avoiding severe exchange rate misalignments, while retaining, to some degree, the anchor role of the exchange rate with a regular path of mini-devaluations. The share of tightly managed floats rose as authorities attempted to keep the anchor role of the exchange rate without precommitting to a specific target path.

The shift away from intermediate regimes has also been more pronounced among the developed and emerging market countries that are highly integrated with international capital markets (see Figure 5 and also Fischer (2001)).[26] Intermediate regimes have almost disappeared in the developed countries. The substitution of the ERM bands with a monetary union accounted for

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[23] We base the ordering of regimes on the degree of flexibility of exchange rate policy rather than the flexibility of the exchange rate. While the two concepts often overlap, sometimes there may not be a clear cut ordering without knowing the precise parameters of each regime.

[24] These regimes have broadly coincided with those that came under more frequent exchange market pressure (see the companion paper, Bubula and Otkcr-Robe (2002), for an analysis of the frequency of currency crises across alternative exchange rate regimes). However, the sharp decline in the share of horizontal bands also reflected the substitution of ERM bands with the membership in the European Monetary Union as part of a planned political and economic integration.

[25] For example, Russia (1998), Brazil and Kazakhstan (1999), Turkey (1994, 2001), and Venezuela (1994) abandoned crawling pegs during currency crises, while others, including Portugal (1990), Mexico (1991), Indonesia, Poland, and Sri Lanka (1995), Honduras (1996), and Belarus and Romania (2001) introduced a band around the crawling parities.

[26] The developed country definition used here coincides with that of the IMF's *International Financial Statistics* (IFS). There is no broadly agreed definition for emerging markets. The list used here is based on a number of existing definitions that combine the countries included in the Emerging Markets Bond Index Plus (EMBI+) and Morgan Stanley Capital International (MSCI) index, except Greece, which is included in the developed countries group, and Singapore and Hong Kong SAR in the emerging markets group. This gives a list of 32 emerging markets.

Figure 5. Trend Toward Polarization of Exchange Rate Regimes Across Country Groups in 1990 and 2001 1/
(In percent of membership in each group)

All Countries

Developed Countries

Emerging Market Countries 2/

Developed and Emerging Market Countries

Nonemerging Market Developing Countries

Transition Economies
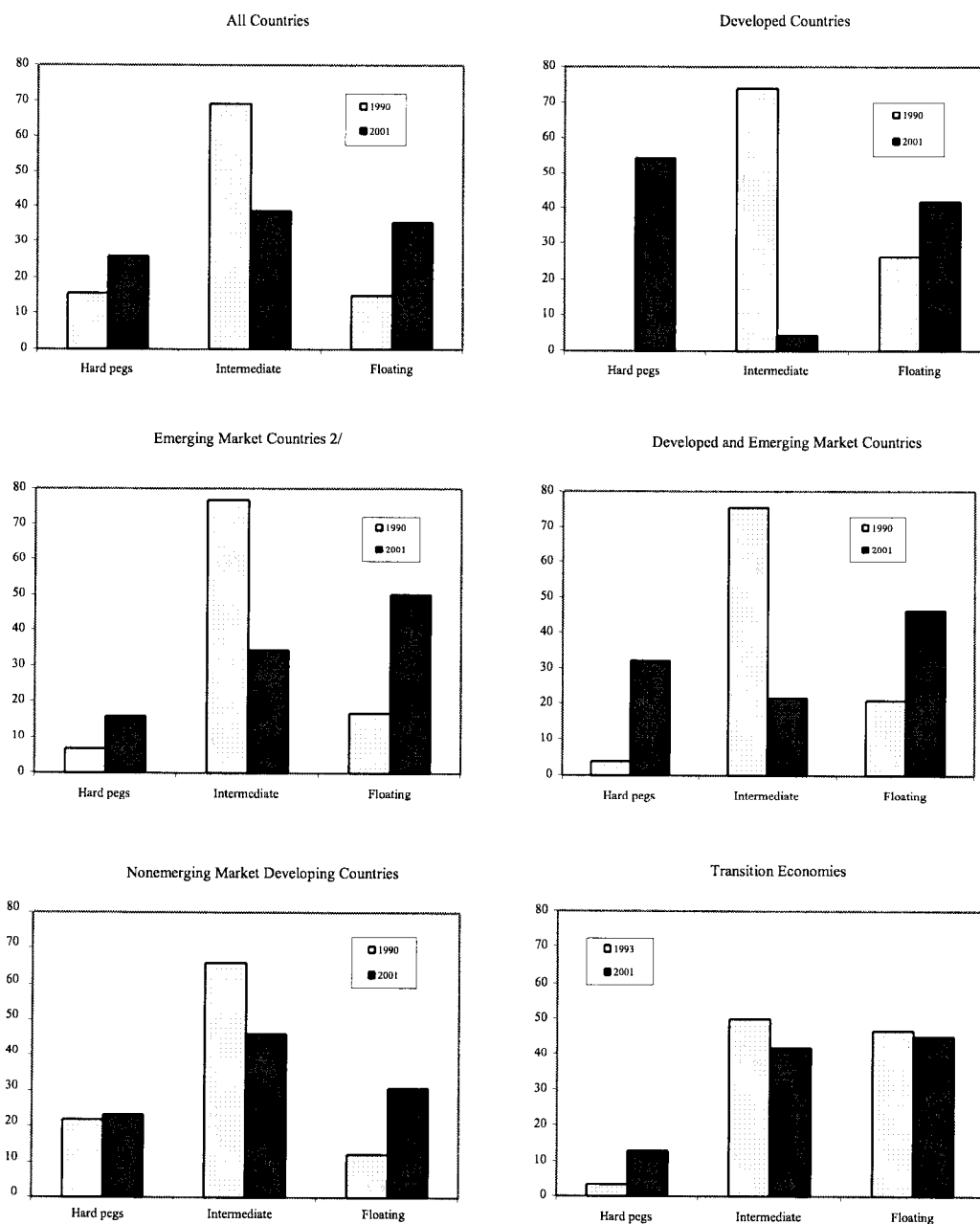
Source: Staff estimates.

1/ Hard pegs = formal dollarization+currency unions+currency boards
   intermediate = conventional fixed pegs+horizontal bands+crawling pegs+crawling bands+tightly managed floats
   floating = independently floats+ other managed floats with no predetermined path for the exchange rate.
2/ The definitions of the developed and developing countries coincide with that of the *IFS*. The list of emerging market countries is based on a
   number of existing definitions that combine the countries included in the Emerging Markets Bond Index Plus (EMBI+) and Morgan Stanley
   Capital International (MSCI) index, with a few exceptions: Greece is included in the developed countries group and Singapore and Hong Kong SAR
   are included in the emerging countries group. This gives a list of 32 countries: Argentina, Brazil, Bulgaria, Chile, China, Colombia, the Czech
   Republic, Egypt, Ecuador, Hong Kong, Hungary, India, Indonesia, Israel, Jordan, Korea, Malaysia, Mexico, Morocco, Nigeria, Pakistan, Panama,
   Peru, the Philippines, Poland, Russia, Singapore, South Africa, Sri Lanka, Thailand, Turkey, and Venezuela.

most of the decline, while a part of the fall was owed to the replacement of band regimes with floating rates during the ERM turmoil in 1992 (Norway, Sweden, and the United Kingdom) or in the context of a change in the overall monetary policy framework (for example, Iceland recently). In the emerging market countries, there has been a marked shift toward floating regimes. Many moved to more flexible regimes following a sharp reversal of capital inflows during the 1990s, while others as a result of a deliberate policy choice to enhance monetary policy in coping with capital flows.[27] The move to greater flexibility also reflected a desire to limit speculative capital flows typically encouraged by pegged or tightly managed exchange rate regimes. Still, several emerging markets adopted more rigid exchange rate regimes (Argentina, Bulgaria, Ecuador), sharply reducing or entirely giving up monetary autonomy, with the hope that the greater discipline imposed by such regimes would enhance policy credibility and make currencies less subject to speculative pressures.

The greater degree of regime polarization in these countries has been attributed to the principle of "impossible trinity," that is, that only two of the three goals of exchange rate stability, capital mobility, and monetary policy independence can be attained simultaneously (see Fischer, 2001, and Frankel, 1999). The viability of intermediate regimes has been questioned as countries attempted to maintain a stable exchange rate while directing monetary policy to achieve domestic objectives in an environment with increased capital mobility. The growing integration of financial markets in recent years has in turn forced countries to choose between exchange rate stability or monetary independence—hence the apparent polarization of the regimes.[28] Intermediate regimes have remained a feasible alternative for those countries that have not yet been open to capital flows.

Regardless of the underlying causes, however, the observed trend away from the intermediate regimes cannot by itself provide strong evidence that intermediate regimes will vanish eventually, as some proponents of the "hollowing middle" or "bipolar" view have argued. A more formal analysis of this hypothesis is carried out in the following section.

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[27] For example, Mexico (1994), the Czech Republic, Korea, Indonesia, the Philippines, and Thailand (all in 1997), Russia (1998), Brazil and Colombia (1999), and Turkey (2001) floated during crises. Chile (1999) and Poland (2000) floated in a relatively tranquil period to make the direct inflation targeting the overriding target of monetary policy.

[28] Note, however, that for many emerging market countries, the extent of monetary independence has remained constrained by the reluctance to accept wide fluctuations in exchange rates, given the highly volatile nature of capital flows to these countries.

IV. EVOLUTION OF EXCHANGE RATE REGIMES: EVIDENCE FROM A MARKOV ANALYSIS

Whether the observed trend will persist until all intermediate regimes disappear can be examined more formally by analyzing if there were no exits from either hard pegs or floats (that is, if hard pegs or floats were an "absorbing state"), or if hard pegs and floats together formed a "closed set" with no transitions to intermediate regimes from the other two. A statistical test of this hypothesis was conducted in Masson (2001), who applied a Markov chain model to estimate the probabilities of transitions between three regime categories of hard pegs, intermediate regimes, and floats.[29] In testing these hypotheses, Masson used two alternative regime classifications (GGOW, 1997; and Levy-Yeyati and Sturzenegger, 1999) with somewhat different definitions of hard pegs and floating regimes than those adopted in this paper.[30] The paper concluded that neither data provided firm support for a substantial move away from middle regimes, and that these regimes will continue to exist in steady state, or at least, will take a very long time to disappear.

The estimated probabilities of transitions between hard pegs, intermediate regimes, and floating regimes based on the de facto regime classifications of this paper are broadly consistent with the main finding of Masson (2001), despite the differences in the frequency of the data and the use of different regime classifications. Table 4 presents these probabilities over 186 countries using monthly data over the period 1990–2001. For example, given that the current month's regime is a hard peg, the estimated probability of remaining in a hard peg regime next month is 99.83 percent (i.e., $p_{11} = 0.9983$) and that of moving to an intermediate or a floating regime is 0.06 percent and 0.10 percent, respectively (i.e., $p_{12} = 0.0006$ and $p_{13} = 0.0010$). Similarly, the estimated probability of moving next month from a floating regime to a hard peg or an intermediate regime are 0.03 percent and 1.07 percent, respectively.[31]

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[29] Using the Markov chain model for exchange regime transitions assumes that the probability of being in one or another regime next period depends only the current regime, supposing that "the typical country will face the same likelihood that some shock will push it from its current regime to one of the others—independent of past history" (see Masson, 2001, p. 573). Some basic definitions and terminology on Markov chains are given in Appendix III.

[30] Using data from GGOW, 1997, over 1979–97, "floating regimes" were associated with free floats and "hard pegs" with announced pegs (soft or hard) with virtually no changes in parities. All other regimes (including managed floats, target zones, crawling pegs, and hard or soft fixed pegs with parity adjustments) were included in the "intermediate category." The definition of hard pegs was hence based on expost exchange rate rigidity, and not necessarily the commitment implied by the formal arrangement. With Levy-Yeyati and Sturzenegger data over 1991–98, the inconclusive group was dropped, dirty floats and crawling pegs made up the intermediate group, and fixed and flexible categories formed the hard peg and floating categories, respectively.

[31] The last column of the table reports the number of observations each regime was initially in effect over the sample; more specifically, 4,840, 13,915, and 6,791 are the total number of

These probabilities suggest that all three regimes are highly persistent (the most persistent being the hard pegs, followed by intermediate regimes, then floats), suggesting a high probability of remaining within a given regime once entered.[32] However, the matrix is also "irreducible" (i.e., it is possible to reach any regime from any other regime), as there have been transitions from hard pegs to both intermediate and floating regimes, and from floating regimes to both intermediate regimes and hard pegs.[33] Strictly speaking, then, the existence of exits from hard pegs and floats to intermediate regimes (that is, nonzero transition probabilities to intermediate regimes) provides clear evidence that the hypothesis of "hollowing out of the middle" is not supported by the data; that is, neither hard pegs or floats are "absorbing states," nor do they form a "closed set" together.[34]

Table 4. Estimated Transition Matrix for All Countries, 1990–2001

| Regime in period t | Estimated probability of regime in $t+1$ | | | |
	Hard pegs	Intermediate	Floating	Total observations
Hard pegs	0.9983	0.0006	0.001	4,840
Intermediate	0.0012	0.9909	0.0078	13,915
Floating	0.0003	0.0107	0.989	6,791
Total				25,546
Memorandum items:				
In percent:				
Shares in Jan. 1990	15.29	70.06	14.65	157 members
Shares in Dec. 2001	25.81	38.71	35.48	186 members
Steady-state distribution	32.94	37.43	29.63	

Source: Authors' estimates.

initial hard pegs, intermediate regimes, and floating regimes, respectively. Not all countries' regimes were available for all dates given the varying membership over time.

[32] The very high degree of persistence is partly due to the monthly frequency of the regimes data, as there is a higher probability of staying within the same regime from month to month than from year to year. The probabilities using annual (end-year) regimes data over the 1990–2001 period are $p_{11} = 0.9780$, $p_{22} = 0.9031$ $p_{33} = 0.8876$.

[33] The few shifts that occurred from hard pegs are accounted for by the exits from using as sole legal tender the ruble and the rand by several former Soviet Union states and Namibia, respectively, and by Argentina's float in end-December 2001 from a currency board. There are many examples of transitions from floats to intermediate regimes (including, for example, Finland and Italy from free float to ERM bands, Venezuela, Jamaica, Malawi from free floats to fixed pegs, Malaysia and Pakistan from managed float to fixed pegs, etc.).

[34] See Masson (2001, p. 576) for a similar conclusion and Appendix III for a discussion.

The transition probabilities over the whole membership therefore suggest that despite the decline in their share, intermediate regimes would be part of the long-run distribution of exchange regimes based on historical data for transitions and assuming that there are no major shocks to the system. On the one hand, there is a clear decline in the prevalence of intermediate regimes: at the beginning of the 1990s, the countries with intermediate regimes represented close to 70 percent of all membership, while at end-2001 only 39 percent maintained such regimes. On the other hand, the transition probabilities imply that intermediate regimes would not disappear in the long run, as suggested by the steady-state distribution of regimes that assign more than one-third share to intermediate regimes—a higher share than those of hard peg and floating regimes.[35] If there are structural shifts over time, however (e.g., due to a sharp increase in capital mobility for the whole membership or to political shocks that may lead to more currency unions), the distribution of regimes in the future may differ from that in steady state. Such shifts could cause unpredictable changes in the direction of regimes.

The data indeed point to some evidence of structural instability over the sample period—a result that calls for a cautious interpretation of the implications suggested by the steady-state distribution. Dividing the sample into two equal subperiods, the structural stability test rejects the null hypothesis that the transition probabilities estimated from each subsample are the same as the parameters from the whole sample (the test statistic, 39.5, is significant with a p-value < 0.001). More detailed structural stability tests (discussed in Appendix III) also suggest that hard pegs and floating regimes became more persistent in the second subperiod (i.e., since 1996). The evidence of a significant increase in the retention rate of the two poles argues in favor of the bipolar view, since through time the extremes of the flexibility spectrum appear to be more persistent. The insignificant change in the persistence of intermediate regimes between the two periods, however, suggests that the trend toward polarization may not be the result of an acceleration in the exit rate from intermediate regimes, but instead of the fact that in the later period countries became less likely to change regimes once an exit occurs from intermediate regimes. Additional evidence from the future evolution of exchange rate regimes would hence be necessary to establish more concrete evidence against the vanishing middle proposition.

Table 5 provides some additional insight from the dynamics of transitions for finer categories of intermediate regimes to see how different intermediate regimes are moving toward the two poles. The diagonal elements of the transition matrix indicate that basket pegs, forward-looking crawling bands, and single currency pegs were the most persistent, and thus the most durable, regimes within the intermediate regime category, while crawling pegs, backward-looking crawling bands, and horizontal bands were the least enduring. The latter regimes, as a result,

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[35] The analysis of the previous section had indicated that the trend away from intermediate regimes was more pronounced for the developed and emerging market countries that are fully or increasingly more integrated with international capital markets. Partial tests not reported here suggest that the result against the bipolar view is robust to restricting the sample to these groups of countries, although for this group, intermediate regimes are expected to hold a much lower share in steady state than hard pegs and floating regimes.

Table 5. All Countries: Estimated Transition Probabilities with a Finer Categorization of Intermediate Regimes
(January 1990–December 2001)

	Hard Pegs	Single Currency Peg	Basket Peg	Forward-Looking Crawling Peg	Horizontal Band	Forward-Looking Crawling Band	Backward-Looking Crawling Peg	Backward-Looking Crawling Band	Tightly Managed	Floating	Total Observations
Hard pegs	**0.9983**	0.0006	0	0	0	0	0	0	0	0.0010	4,840
Single currency peg	0.0010	**0.9855**	0.0004	0.0006	0.0010	0.0002	0.0010	0.0002	0.0018	0.0084	5,024
Basket peg	0	0.0008	**0.9902**	0.0004	0.0015	0	0.0008	0	0.0008	0.0057	2,653
Forward-looking crawling peg	0	0.0051	0	**0.9730**	0.0017	0.0101	0.0034	0	0	0.0067	593
Horizontal band	0.0057	0.0023	0	0	**0.9811**	0.0011	0	0.0011	0.0011	0.0075	1,742
Forward-looking crawling band	0	0.0013	0	0	0.0026	**0.9894**	0	0	0	0.0066	757
Backward-looking crawling peg	0.0009	0.0026	0.0009	0.0053	0.0018	0.0009	**0.9764**	0.0018	0.0026	0.0070	1,142
Backward-looking crawling band	0	0.0037	0	0	0.0037	0.0110	0	**0.9706**	0	0.0110	272
Tightly managed	0.0006	0.0035	0	0.0006	0	0	0.0023	0	**0.9821**	0.0110	1,732
Floating	0.0003	0.0040	0.0001	0.0004	0.0015	0.0001	0.0003	0.0001	0.0041	**0.9890**	6,791
											25,546
Share on Jan. 1990	15.29	28.03	19.11	3.18	8.28	0.00	7.01	1.27	3.18	14.65	157
Share on Dec. 2001	25.81	16.67	5.38	1.61	2.69	3.23	0.54	0.00	8.60	35.49	186
Steady state	**32.27**	**14.22**	**1.26**	**1.47**	**4.19**	**3.33**	**2.15**	**0.55**	**9.28**	**31.29**	

Source: Authors' estimates.

have been subject to more frequent exits compared with forward-looking crawling bands and conventional fixed pegs (Table 6 and Figure 6).

Consequently, among the intermediate regimes, crawling peg, horizontal band, and backward-looking crawling band regimes are likely to lose most of their share in the long run based on past history. Basket pegs lose almost all of their share in steady state as well, although they have the highest persistence across all intermediate regimes. This is because countries seem much less likely to switch to basket pegs, conditional on starting from a different regime, as indicated by the largest number of zeros and the very small values of nonzero transition probabilities of switching to this regime (see the fourth column of Table 5). Forward-looking crawling bands and tightly managed floats, whose shares have increased over the past decade, are expected to continue this trend (provided that there are no significant shocks to the system), as suggested by the transition probabilities of switching to these regimes and their steady-state distribution. Consistent with Figure 3 in Section III, the estimated transition probabilities also show that most intermediate regimes end up with a float rather than being absorbed in a hard peg or another intermediate regime.

V. CONCLUDING REMARKS

There has been growing support in recent years for the view that increased capital mobility has pushed countries toward either greater fixity or flexibility of exchange rate regimes, and that the regimes between the two extremes will be hollowing out as countries abandon regimes in the middle ground. Some have argued that the trend toward greater flexibility is to a certain degree a fallacy, as a number of countries declaring to be officially floating maintained informal exchange rate targets for a variety of reasons. Such divergence has in turn been used to challenge the validity of the bipolar view. This paper presented a monthly database on de facto exchange rate regimes of the IMF members during 1990–2001. It then used this database to examine the evolution of various exchange rate regimes since 1990 to see whether the bipolar view would still be supported if the analysis were based on de facto, as opposed to de jure, exchange rate regimes.

The simple analyses of trends in de facto exchange rate regimes support the earlier claims (for example of Fischer, 2001) that the proportion of countries adopting intermediate regimes has been shrinking in favor of either greater flexibility or greater fixity over the past decade or so, but more so for the countries that are fully or increasingly more integrated with the international financial markets. The analysis also shows that the extent of the decline has not been uniform across different types of intermediate regimes. In particular, countries have tended to move to more flexible forms of intermediate regimes, away from less flexible ones, in part to minimize potential trade-offs between competing policy objectives in a world with growing mobility of capital.

Table 6. The Frequency of Regime Shifts Under Alternative Exchange Rate Regimes by Members, 1990–2001

	Toward Greater Flexibility		Toward Less Flexibility		Total	
	Total number 1/	Frequency (In percent) 2/	Total number 1/	Frequency (In percent) 2/	Total number 1/	Frequency (In percent) 2/
Exit from						
Hard peg regimes	8	0.16	--	--	8	0.16
Formal dollarization	7	0.87	…	…	7	0.87
Currency unions	--	--	--	--	--	--
Currency boards	1	0.12	--	--	1	0.12
Intermediate regimes	164	1.18	58	0.42	222	1.60
Conventional fixed peg to a single currency	68	1.35	5	0.10	73	1.45
Conventional fixed peg to a basket	24	0.90	2	0.08	26	0.98
Horizontal bands	19	1.09	14	0.80	33	1.89
Crawling pegs	26	1.50	17	0.98	43	2.48
Forward looking	13	2.19	3	0.51	16	2.70
Backward looking	13	1.14	14	1.23	27	2.37
Crawling bands	8	0.78	8	0.78	16	1.55
Forward looking	5	0.66	3	0.40	8	1.06
Backward looking	3	1.10	5	1.84	8	2.94
Tightlymanaged floating	19	1.10	12	0.69	31	1.79
Floating regimes	30	0.44	99	1.46	129	1.90
Other managed floating	30	0.90	54	1.62	84	2.52
Independently floating	…	…	45	1.30	45	1.30
Total	202	…	157	…	359	…

Source: Authors' estimates.

1/ Indicates the total number of exits from each regime during the period January 1990-December 2001.

2/ Defined as the total number of exits from a given regime as a ratio of the total number of observations during which the regime as in effect over the sample.

Figure 6. Exit Frequency and Regime Persistence Across Intermediate Regimes, 1990–2001
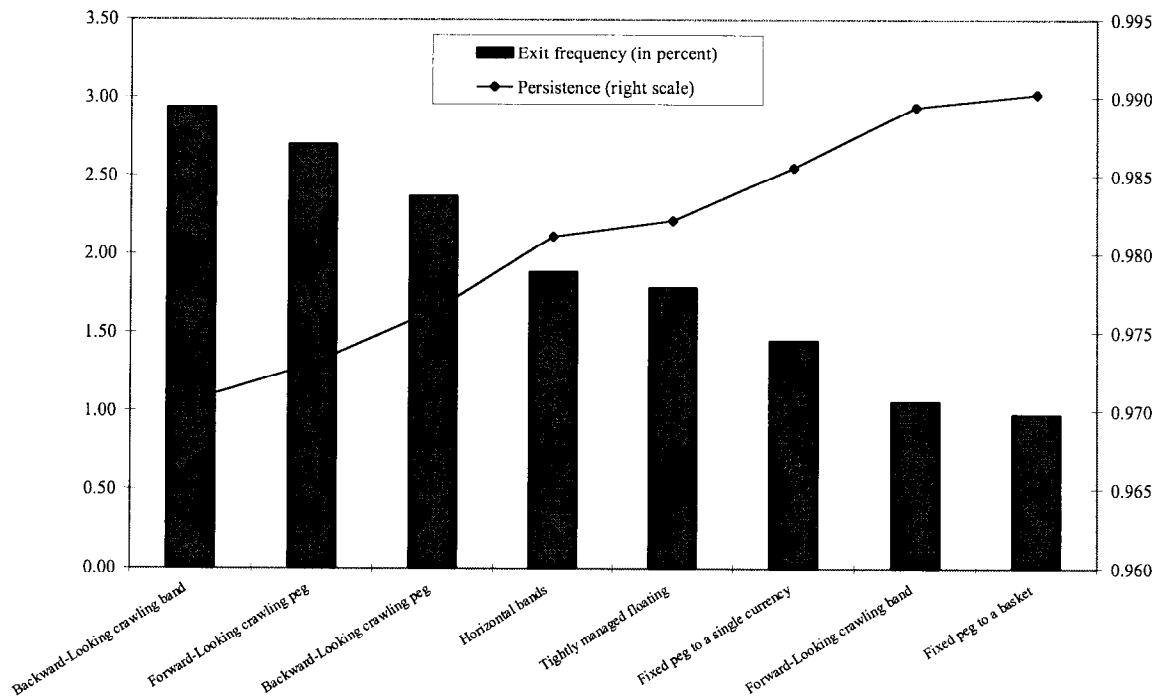
A more detailed analysis of the exchange regime transitions using Markov chains provides mixed evidence for the validity of the bipolar view. On the one hand, despite the marked shift toward the two poles of exchange rate regimes during 1990–2001, the history of regime transitions between hard pegs, intermediate and floating regimes points to no strong evidence to suggest that intermediate regimes will disappear. Some evidence of structural instability in the sample, however, suggests that this result be taken cautiously. The structural stability tests indicate in particular that the trend toward polarization may be the result of the fact that countries became less likely in the later part of the decade to leave the two poles upon exiting from intermediate regimes. Additional evidence from the future evolution of exchange rate regimes would hence be necessary to see if this trend would continue and hence to establish more concrete evidence for or against the vanishing middle proposition.

Table 7. Database on De Facto Exchange Regime Classification
(End of year)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Afghanistan, I.S. of	12	12	13	13	13	13	13	13	13	13	13	13
Albania		4	13	13	13	13	13	13	13	13	13	13
Algeria	5	5	5	5	12	12	12	12	12	12	12	12
Angola	4	4	4	4	12	4	4	4	4	13	13	12
Antigua and Barbuda	2	2	2	2	2	2	2	2	2	2	2	2
Argentina	13	3	3	3	3	3	3	3	3	3	3	3
Armenia			1	12	11	11	12	12	12	12	12	13
Aruba	4	4	4	4	4	4	4	4	4	4	4	4
Australia	13	13	13	13	13	13	13	13	13	13	13	13
Austria	4	4	4	4	4	4	4	4	4	2	2	2
Azerbaijan			4	4	12	12	12	11	11	11	11	11
Bahamas, The	4	4	4	4	4	4	4	4	4	4	4	4
Bahrain	4	4	4	4	4	4	4	4	4	4	4	4
Bangladesh	4	4	4	4	4	11	11	11	4	4	4	4
Barbados	4	4	4	4	4	4	4	4	4	4	4	4
Belarus			12	12	12	4	9	9	9	9	7	8
Belgium	6	6	6	6	6	6	6	6	6	2	2	2
Belize	4	4	4	4	4	4	4	4	4	4	4	4
Benin	2	2	2	2	2	2	2	2	2	2	2	2
Bhutan	4	4	4	4	4	4	4	4	4	4	4	4
Bolivia	9	9	9	9	9	9	9	9	9	7	7	7
Bosnia					4	4	4	3	3	3	3	3
Botswana	5	5	5	5	5	5	5	5	5	5	5	5
Brazil	12	9	9	9	11	9	9	9	7	13	13	13
Brunei Darussalam	3	3	3	3	3	3	3	3	3	3	3	3
Bulgaria	5	13	13	11	11	11	13	3	3	3	3	3
Burkina Faso	2	2	2	2	2	2	2	2	2	2	2	2
Burundi	5	5	5	5	5	5	5	5	5	12	12	12
Cambodia	12	12	12	12	12	12	12	12	12	12	12	12
Cameroon	2	2	2	2	2	2	2	2	2	2	2	2
Canada	12	12	12	12	12	12	12	12	13	13	13	13
Cape Verde	5	5	5	5	5	5	5	5	4	4	4	4
Central African Republic	2	2	2	2	2	2	2	2	2	2	2	2
Chad	2	2	2	2	2	2	2	2	2	2	2	2
Chile	10	10	10	10	10	10	10	10	8	13	13	13
China	4	12	12	12	12	4	4	4	4	4	4	4
Colombia	9	8	8	8	8	8	8	8	8	13	13	13
Comoros	4	4	4	4	4	4	4	4	4	4	4	4
Congo, Democratic Republic	12	12	12	12	12	13	13	13	12	4	4	13
Congo, Republic of	2	2	2	2	2	2	2	2	2	2	2	2
Costa Rica	9	9	11	9	9	9	7	7	9	9	9	9

Table 7. Database on De Facto Exchange Regime Classification
(End of year)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Côte d'Ivoire	2	2	2	2	2	2	2	2	2	2	2	2
Croatia			9	6	6	6	6	6	6	11	11	11
Cyprus	5	5	6	6	6	6	6	6	6	6	6	6
Czechoslovakia	5	5	5									
Czech Republic				5	5	5	6	12	12	12	12	13
Denmark	6	6	6	6	6	6	6	6	6	6	6	6
Djibuti	3	3	3	3	3	3	3	3	3	3	3	3
Dominica	2	2	2	2	2	2	2	2	2	2	2	2
Dominican Republic	4	11	11	11	12	12	12	12	12	12	12	12
Ecuador	7	7	6	10	8	8	8	8	8	13	1	1
Egypt	4	6	6	6	6	6	6	4	4	12	12	6
El Salvador	11	11	12	4	4	4	4	4	4	4	4	1
Equatorial Guinea	2	2	2	2	2	2	2	2	2	2	2	2
Eritrea					4	4	4	4	12	12	4	4
Estonia			3	3	3	3	3	3	3	3	3	3
Ethiopia	4	4	4	12	12	12	12	12	12	12	12	12
Fiji	5	5	5	5	5	5	5	5	5	5	5	5
Finland	6	6	13	13	13	13	6	6	6	2	2	2
France	6	6	6	6	6	6	6	6	6	2	2	2
Gabon	2	2	2	2	2	2	2	2	2	2	2	2
Gambia, The	13	13	13	13	13	13	13	13	13	13	13	13
Georgia			1	13	11	11	11	11	13	13	13	13
Germany	6	6	6	6	6	6	6	6	6	2	2	2
Ghana	12	12	12	12	12	12	12	12	12	12	12	12
Greece	7	7	7	7	7	7	7	7	6	6	6	2
Grenada	2	2	2	2	2	2	2	2	2	2	2	2
Guatemala	11	11	11	11	12	12	12	12	12	12	12	12
Guinea	12	12	4	11	11	11	12	12	12	12	12	12
Guinea-Bissau	9	9	9	9	9	9	9	2	2	2	2	2
Guyana	4	12	11	12	11	11	11	11	12	11	11	11
Haiti	4	13	13	13	13	13	13	13	13	13	13	13
Honduras	4	4	13	13	11	7	8	8	8	8	8	8
Hong Kong SAR	3	3	3	3	3	3	3	3	3	3	3	3
Hungary	5	5	5	5	6	8	8	8	8	8	8	6
Iceland	6	6	6	6	6	6	6	6	6	6	6	13
India	6	4	4	4	4	12	11	11	11	11	11	11
Indonesia	9	9	9	9	9	10	10	13	13	13	13	12
Iran, I.R. of	5	5	5	4	4	4	4	4	4	4	4	4
Iraq	4	4	4	4	4	4	4	4	4	12	12	12
Ireland	6	6	6	6	6	6	6	6	6	2	2	2
Israel	6	8	8	8	8	8	8	8	8	8	8	8

Table 7. Database on De Facto Exchange Regime Classification
(End of year)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Italy	6	6	13	13	13	13	6	6	6	2	2	2
Jamaica	12	13	4	12	11	13	12	12	12	12	12	11
Japan	13	13	13	13	13	13	13	13	13	13	13	13
Jordan	5	5	5	5	5	4	4	4	4	4	4	4
Kazakhstan			12	13	13	12	12	4	9	11	11	11
Kenya	5	5	5	12	12	12	12	12	12	12	12	12
Kiribati	1	1	1	1	1	1	1	1	1	1	1	1
Korea	11	11	11	11	11	11	11	13	13	13	13	13
Kuwait	5	5	5	5	5	5	5	5	5	5	5	5
Kyrgyz Republic			1	12	6	6	12	12	12	12	12	12
Lao, People's Dem. Rep.	4	4	4	4	4	4	4	12	12	12	12	12
Latvia			13	12	5	5	5	5	5	5	5	5
Lebanon	12	12	12	7	7	7	7	7	4	4	4	4
Lesotho	4	4	4	4	4	4	4	4	4	4	4	4
Liberia	4	4	4	4	4	4	4	4	13	13	13	13
Libya	5	5	5	5	5	5	5	5	5	5	5	5
Lithuania			13	11	3	3	3	3	3	3	3	3
Luxembourg	4	4	4	4	4	4	4	4	4	2	2	2
Macedonia			12	13	12	4	4	4	4	4	4	4
Madagascar	5	5	5	5	13	12	12	13	13	13	13	13
Malawi	5	5	5	5	4	4	4	12	12	12	13	13
Malaysia	5	12	12	12	12	11	11	12	4	4	4	4
Maldives	12	12	12	12	4	4	4	4	4	4	4	4
Mali	2	2	2	2	2	2	2	2	2	2	2	2
Malta	5	5	5	5	5	5	5	5	5	5	5	5
Marshall Islands			1	1	1	1	1	1	1	1	1	1
Mauritania	5	5	5	5	5	5	12	11	11	11	11	11
Mauritius	5	5	5	5	12	12	12	13	13	12	12	12
Mexico	7	8	8	8	13	13	13	13	13	13	13	13
Micronesia			1	1	1	1	1	1	1	1	1	1
Moldova			1	12	12	11	11	11	13	13	13	13
Mongolia		4	4	13	13	13	13	12	12	13	11	11
Morocco	5	5	5	5	5	5	5	5	5	5	5	5
Mozambique	9	9	12	13	13	13	13	13	13	13	13	13
Myanmar	5	5	5	5	5	12	12	12	12	12	12	12
Namibia	1	1	1	4	4	4	4	4	4	4	4	4
Nepal	4	4	4	4	4	4	4	4	4	4	4	4
Netherlands	4	4	4	4	4	4	4	4	4	2	2	2
Netherlands Antilles	4	4	4	4	4	4	4	4	4	4	4	4
New Zealand	13	13	13	13	13	13	13	13	13	13	13	13
Nicaragua	9	4	4	7	7	7	7	7	7	7	7	7

Table 7. Database on De Facto Exchange Regime Classification
(End of year)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Niger	2	2	2	2	2	2	2	2	2	2	2	2
Nigeria	11	11	11	4	4	11	11	11	11	11	11	11
Norway	6	6	13	11	11	11	11	12	12	12	12	13
Oman	4	4	4	4	4	4	4	4	4	4	4	4
Pakistan	11	11	11	11	11	11	4	4	12	4	12	12
Palau								1	1	1	1	1
Panama	1	1	1	1	1	1	1	1	1	1	1	1
Papua New Guinea	5	5	5	5	13	13	13	13	13	13	13	13
Paraguay	11	11	11	11	11	11	11	11	11	11	11	11
Peru	13	13	12	12	12	12	12	12	12	13	13	13
Philippines	4	12	12	12	12	4	4	12	13	12	13	13
Poland	4	7	7	7	7	8	8	8	8	8	13	13
Portugal	8	8	6	6	6	6	6	6	6	2	2	2
Qatar	4	4	4	4	4	4	4	4	4	4	4	4
Romania	5	11	11	11	11	11	11	9	9	7	7	8
Russia			12	6	12	7	7	7	12	12	12	12
Rwanda	5	5	5	5	5	13	13	13	12	12	12	12
Samoa	5	5	5	5	5	5	5	5	5	5	5	5
San Marino			1	1	1	1	1	1	1	1	1	1
São Tóme and Príncipe	5	9	9	9	12	12	12	12	11	11	11	11
Saudi Arabia	4	4	4	4	4	4	4	4	4	4	4	4
Senegal	2	2	2	2	2	2	2	2	2	2	2	2
Seychelles	5	5	5	5	5	5	5	5	5	5	5	5
Sierra Leone	13	13	13	13	13	13	13	13	13	13	13	13
Singapore	11	11	11	11	11	11	11	12	12	12	11	11
Slovak Republic			6	6	6	6	6	6	12	12	12	12
Slovenia			9	9	6	12	6	6	12	12	12	12
Solomon Islands	9	9	9	9	9	9	9	9	9	9	7	7
Somalia	12	13	13	13	13	13	13	13	13	13	13	13
South Africa	12	12	12	12	12	11	12	13	13	13	13	13
Spain	6	6	6	6	6	6	6	6	6	2	2	2
Sri Lanka	9	9	9	9	9	10	10	10	10	10	10	12
St Kitts and Nevis	2	2	2	2	2	2	2	2	2	2	2	2
St Lucia	2	2	2	2	2	2	2	2	2	2	2	2
St Vincent and Grenadines	2	2	2	2	2	2	2	2	2	2	2	2
Sudan	4	4	12	4	12	13	12	12	13	4	4	4
Suriname	4	4	4	4	12	12	4	4	4	4	6	4
Swaziland	4	4	4	4	4	4	4	4	4	4	4	4
Sweden	6	6	13	13	13	13	13	13	13	13	13	13
Switzerland	13	13	13	13	13	13	13	13	13	13	13	13
Syrian Arab Republic	4	4	4	4	4	4	4	4	4	4	4	4

Table 7. Database on De Facto Exchange Regime Classification
(End of year)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Tajikistan				12	12	12	12	4	12	12	13	13
Tanzania	11	11	11	13	13	13	13	13	13	13	13	13
Thailand	5	5	5	5	5	5	5	12	12	12	12	12
Togo	2	2	2	2	2	2	2	2	2	2	2	2
Tonga	4	5	5	5	5	5	5	5	6	6	6	6
Trinidad and Tobago	4	4	4	13	11	11	11	4	4	4	4	11
Tunisia	9	9	9	9	9	9	9	9	9	9	12	12
Turkey	9	9	9	9	7	9	9	9	7	7	7	13
Turkmenistan			1	4	4	4	11	4	4	4	4	4
Uganda	12	12	13	13	13	13	13	13	13	13	13	13
Ukraine			12	4	12	12	6	6	6	12	11	11
United Arab Emirates	4	4	4	4	4	4	4	4	4	4	4	4
United Kingdom	6	6	13	13	13	13	13	13	13	13	13	13
United States	13	13	13	13	13	13	13	13	13	13	13	13
Uruguay	10	10	8	8	8	8	8	8	8	8	8	8
Uzbekistan			1	4	11	11	11	9	9	9	11	12
Vanuatu	5	5	5	5	5	5	5	5	5	5	5	5
Venezuela	12	12	12	9	4	4	8	8	8	8	8	8
Vietnam	12	12	12	12	4	4	6	6	6	11	11	11
Yemen Arab Republic	4	4	4	4	4	4	13	13	13	12	12	13
Yugoslavia	4	4	13		4	4	4	4	4	4	4	11
Zambia	9	9	13	13	13	13	12	13	13	13	13	12
Zimbabwe	5	5	5	5	10	10	10	12	12	4	4	4

Note:
1 = Another currency as legal tender; 2 = currency union; 3 = currency board; 4 = conventional fixed peg to single currency;

5 = conventional fixed peg to basket; 6 = pegged within a horizontal band; 7 = forward-looking crawling peg;

8 = forward-looking crawling band; 9 = backward-looking crawling peg; 10 = backward-looking crawling band;

11 = tightly managed floating; 12 = other managed floating; and 13 = independently floating.

Table 8. Evolution of Exchange Rate Regimes
(In percent of members in the given category)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Average (1990-2001)
Whole membership													
Dollarization	1.9	1.9	6.1	2.7	2.7	2.7	2.7	3.2	3.2	3.2	3.8	4.3	3.2
Currency union	11.9	11.8	10.6	10.4	10.3	10.3	10.3	10.8	10.8	16.7	16.7	17.2	12.3
Currency board	1.9	2.5	2.8	2.7	3.2	3.2	3.2	4.3	4.3	4.3	4.3	4.3	3.4
Fixed peg to a currency	24.5	21.7	18.9	19.8	20.0	21.6	20.0	20.4	19.9	18.8	18.3	16.7	20.1
Fixed peg to a basket	19.5	17.4	15.0	13.7	10.3	8.6	7.6	7.0	5.9	5.4	5.4	5.4	10.1
Horizontal band	8.8	8.1	6.1	7.1	8.1	7.0	9.7	8.6	8.6	2.7	3.2	2.7	6.7
Crawling peg	9.4	9.3	7.2	8.8	6.5	6.5	6.5	7.0	5.9	4.8	3.8	2.2	6.5
Crawling band	1.9	3.7	2.8	3.3	3.2	5.4	6.5	5.4	5.4	3.8	3.2	3.2	4.0
Tightly managed float	5.0	6.2	6.1	6.0	8.6	9.7	8.1	4.8	3.2	5.4	7.5	8.6	6.6
Other managed float	9.4	9.9	11.7	11.5	14.1	10.8	13.0	14.0	16.1	16.7	14.5	14.0	13.0
Independently floating	5.7	7.5	12.8	13.7	13.0	14.1	12.4	14.5	16.7	18.3	19.4	21.5	14.1
Developed countries													
Dollarization	0.0	0.0	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2	3.5
Currency union	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.8	45.8	50.0	11.8
Currency board	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fixed peg to a currency	13.0	13.0	12.5	12.5	12.5	12.5	12.5	12.5	12.5	0.0	0.0	0.0	9.5
Fixed peg to a basket	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Horizontal band	52.2	52.2	33.3	33.3	33.3	33.3	41.7	41.7	45.8	12.5	12.5	4.2	33.0
Crawling peg	4.3	4.3	4.2	4.2	4.2	4.2	4.2	4.2	0.0	0.0	0.0	0.0	2.8
Crawling band	4.3	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Tightly managed float	0.0	0.0	0.0	4.2	4.2	4.2	4.2	0.0	0.0	0.0	0.0	0.0	1.4
Other managed float	4.3	4.3	4.2	4.2	4.2	4.2	4.2	8.3	4.2	4.2	4.2	0.0	4.2
Independently floating	21.7	21.7	41.7	37.5	37.5	37.5	29.2	29.2	33.3	33.3	33.3	41.7	33.1
Developing countries													
Dollarization	2.2	2.2	6.4	2.5	2.5	2.5	2.5	3.1	3.1	3.1	3.7	4.3	3.2
Currency union	14.0	13.8	12.2	12.0	11.8	11.8	11.8	12.3	12.3	12.3	12.3	12.3	12.4
Currency board	2.2	2.9	3.2	3.2	3.7	3.7	3.7	4.9	4.9	4.9	4.9	4.9	3.9
Fixed peg to a currency	26.5	23.2	19.9	20.9	21.1	23.0	21.1	21.6	21.0	21.6	21.0	19.1	21.7
Fixed peg to a basket	22.8	20.3	17.3	15.8	11.8	9.9	8.7	8.0	6.8	6.2	6.2	6.2	11.7
Horizontal band	1.5	0.7	1.9	3.2	4.3	3.1	5.0	3.7	3.1	1.2	1.9	2.5	2.7
Crawling peg	10.3	10.1	7.7	9.5	6.8	6.8	6.8	7.4	6.8	5.6	4.3	2.5	7.1
Crawling band	1.5	3.6	3.2	3.8	3.7	6.2	7.5	6.2	6.2	4.3	3.7	3.7	4.5
Tightly managed float	5.9	7.2	7.1	6.3	9.3	10.6	8.7	5.6	3.7	6.2	8.6	9.9	7.4
Other managed float	10.3	10.9	12.8	12.7	15.5	11.8	14.3	14.8	17.9	18.5	16.0	16.0	14.3
Independently floating	2.9	5.1	8.3	10.1	9.3	10.6	9.9	12.3	14.2	16.0	17.3	18.5	11.2
Emerging markets													
Dollarization	3.3	3.3	3.2	3.1	3.1	3.1	3.1	3.1	3.1	3.1	6.3	6.3	3.7
Currency union	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Currency board	3.3	6.7	6.5	6.3	6.3	6.3	6.3	9.4	9.4	9.4	9.4	9.4	7.4
Fixed peg to a currency	13.3	3.3	3.2	6.3	9.4	12.5	12.5	12.5	12.5	12.5	9.4	9.4	9.7
Fixed peg to a basket	20.0	13.3	12.9	15.6	12.5	9.4	6.3	3.1	3.1	3.1	3.1	3.1	8.8
Horizontal band	6.7	3.3	6.5	6.3	6.3	3.1	6.3	0.0	0.0	0.0	0.0	6.3	3.7
Crawling peg	20.0	20.0	16.1	18.8	12.5	9.4	9.4	9.4	6.3	3.1	3.1	0.0	10.7
Crawling band	3.3	13.3	12.9	15.6	12.5	25.0	28.1	25.0	25.0	15.6	12.5	6.3	16.3
Tightly managed float	13.3	13.3	12.9	12.5	15.6	21.9	15.6	6.3	6.3	6.3	9.4	9.4	11.9
Other managed float	10.0	16.7	22.6	15.6	18.8	6.3	6.3	18.8	18.8	18.8	15.6	15.6	15.3
Independently floating	6.7	6.7	3.2	0.0	3.1	3.1	6.3	12.5	15.6	28.1	31.3	34.4	12.6

MARKOV CHAIN ANALYSIS

Some Basic Definitions and Terminology

Assuming that the stochastic process for the choice of exchange rate regimes can be represented by a Markov chain, the probability of a country being in a given exchange rate regime depends only on its regime in the most recent previous period.[36] A great advantage of the Markov representation is that it compresses the history of exchange rate regimes into a single transition matrix that can be used to characterize the dynamics of shifts between various classes of regimes. Letting the row vector x_t represent the *(1xn)* distribution of n regimes at time t, the probability of moving from regime i to j can be written as $p_{ij} = \Pr(X_{t+1} = j \mid X_t = i)$, where $i, j = 1, 2, ..., n$, and collected in an $(n \times n)$ transition matrix. Focusing on regime transitions among the three broad regime categories of hard pegs, intermediate, and floating regimes, the transition probability matrix, P, is given by:

$$P = \begin{bmatrix} p_{11} & p_{12} & p_{13} \\ p_{21} & p_{22} & p_{23} \\ p_{31} & p_{32} & p_{33} \end{bmatrix} \quad \sum_{j=1}^{3} p_{ij} = 1 \text{ for all } i=1, 2, 3,$$

where, p_{11} is the probability of staying in a hard peg in period $t+1$ given that period t regime is a hard peg, p_{12} is the probability of moving from a hard peg to an intermediate regime, etc.

Given the history of exchange rate regimes and given that the observations are drawn from a multinomial distribution, the maximum likelihood estimates for the transition probability p_{ij} is simply obtained from the sample frequencies of transitions between regimes, that is, the ratio between the number of transitions from i to j (n_{ij}) and the number of times the time t regime was i

(n_i): $\hat{p}_{ij} = \dfrac{n_{ij}}{n_i}$.[37] The larger the number of observations the more precise point estimates are, since

$\sqrt{n_i}\left(\hat{p}_{ij} - p_{ij}\right)$ is distributed approximately as a normal with mean 0, variance $p_{ij}(1 - p_{ij})$.

Given the transition matrix, the time t forecast of the distribution at time $t+1$ is given by: $X_{t+1}|x_t = x_t * P$. The exchange regime process is *Markovian* if $\Pr(X_s = j \mid X_t = i, X_{t-1} = k, X_{t-2} = l,..) = \Pr(X_s = j \mid X_n = i)$, where $i, j, k, l = 1,2,..., n$, and t<s; that is, the most recent information on the regime is the only relevant information to make predictions about the next period's regime. By repeatedly iterating the transition matrix into the future, one can obtain the expected distribution of X_{t+s}, conditional on the information available at time t as: $X_{t+s}|x_t = x_t * P^s$.

The *invariant (alternatively, long-run or steady state) distribution*, x^{ss}, characterizes the long run proportion of regimes, given by: $x^{ss} = x_t * P$, where x_t is the initial distribution. The invariant

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[36] See Feller (1967), Kemeny and Snell (1960), and Bhat (1972) for more details.

[37] See Anderson and Goodman (1957), and Billingsley (1961) for a proof.

distribution can be expressed as the unique distribution of exchange rate regimes that is mapped by P into itself: $x^{ss} = x^{ss} * P$. [38] A state is said to be *intransient* if it is not destined to be empty in steady state.

The transition matrix of regimes is said to have an *absorbing state*, if it is not possible to reach other states from that state, that is, once entered, the probability of leaving that state is zero. For example, hard pegs are an absorbing state if and only if $p_{11} = 1$ (hence, $p_{12} = p_{13} = 0$). Similarly, floating is an absorbing state if and only if $p_{33} = 1$ (hence, $p_{31} = p_{32} = 0$). A transition matrix can have more than one absorbing state. If there exists a unique long-run distribution, the non-absorbing states are *transient*, that is, they are expected to be empty in the long run.

The transition matrix has a *closed set of states* if no state outside this set can be reached from any state in this set. Transition between states within this set could take place but no transition can occur to the states outside this set. For example, if hard pegs and float form a closed set together, the only transitions from hard pegs or floats can be to each other, and no transition from either hard pegs or floats can occur to intermediate regimes (i.e., $p_{12} = p_{32} = 0$), while transitions can occur from intermediate regimes to either hard peg or floating regimes. If a transition matrix has no closed set, it is called *irreducible*, which means that any state can be reached from any other state, and that all states would prevail in the long run.

Testing Hypothesis of Absorbing States and Closed Sets

Letting $\hat{p}_{ij}$ be the component in row i and column j in the estimated Markov chain, in large samples the vector $\sqrt{n_i}\left(\hat{p}_{ij} - p_{ij}\right)$ is distributed approximately as a normal with mean 0, variance $p_{ij}\left(1 - p_{ij}\right)$ and covariance $-\delta_{ig}p_{ij}p_{gh}$, where n_i is the number of observations starting in regime i, p_{ij} is the true population parameter and δ_{ig} is an indicator function equal to one when $i = g$ and zero otherwise (i.e., the estimates in each row are independent of the estimates in other rows). Therefore, hypotheses tests on the Markov chain can be conducted using a goodness of fit statistic, since under the null $H_0 : p_{i1} = p_{i1}^0$, $p_{i2} = p_{i2}^0$, $p_{i3} = p_{i3}^0$, $\displaystyle\sum_{j=1}^{3} \frac{n_i\left(\hat{p}_{ij} - p^0{}_{ij}\right)^2}{p^0{}_{ij}}$ is distributed as a χ^2 with 2 degrees of freedom.

This approach cannot be adopted for testing whether regime i is absorbing, however, because, under the null, the asymptotic distribution is not normal but collapses to a degenerate distribution. Considering, for instance, the hypothesis of hard pegs being absorbing, the null hypothesis is $H_0 : p_{11} = 1$, $p_{12} = 0$, $p_{13} = 0$. Under this null, the asymptotic variance and covariance of

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[38] The steady-state probabilities are estimated by imposing the following three conditions: $x^{ss} = x^{ss} *$ P, $x^{ss} * J = 1$ $x^{ss} \geq 0$, where J is an *(n x 1)* vector of ones. The latter two conditions entail that x^{ss} is a probability distribution.

$\sqrt{n_i}\left(\hat{p}_{ij} - p_{ij}\right)$ are equal to zero and the asymptotic distribution is not normal. For these reasons, it is sufficient to find in the sample at least one exit from hard pegs in order to reject with certainty the null hypothesis of hard pegs being an absorbing state. Intuitively, since a sample should represent independent draws from the population, only one exit in the sample is inconsistent with a population with no exits. For similar reasons, the evidence in the sample of shifts from hard pegs or from floats to intermediate regimes rules out the possibility that the two polar regimes form a closed set.

Test for Structural Stability

To test for structural stability, the sample was divided into two sub-periods of equal length (January 1990–December 1995 and January 1996–December 2001), estimating the transition matrices for each sub-period and comparing them with the matrix obtained in text Table 3. The estimated transition probabilities for the two sub-periods are given in Table 9.

Table 9. Estimated Transition Matrix for All Countries

Regime in period t	Estimated probability of regime in $t+1$			Total observations
	Hard pegs	**Intermediate**	**Floating**	
(1990–95)				
Hard pegs	0.9966	0.0014	0.0019	2,074
Intermediate	0.0003	0.9916	0.0081	7,637
Floating	0.0000	0.0173	0.9827	2,711
				12,422
(1996–2001)				
Hard pegs	0.9996	0.0000	0.0004	2,766
Intermediate	0.0024	0.9901	0.0075	6,278
Floating	0.0005	0.0064	0.9931	4,080
				13,124

Source: Authors' estimates.

The null hypothesis of structural stability is conducted with a χ^2 test on the statistic:

$$S = \sum_{t=1}^{2}\sum_{i=1}^{3}\sum_{j=1}^{3} \frac{n_{it}\left(\hat{p}_{ijt} - \hat{p}_{ij0}\right)^2}{\hat{p}_{ij0}},$$

where n_{it} and $\hat{p}_{ijt}$ are, respectively, for each sub period, the number of observations that started in the ith regime and the estimated transition probabilities; $\hat{p}_{ij0}$ stands for the transition probability

under the null hypothesis of structural stability using the whole sample. Under the null, the statistic has a χ^2 distribution with 6 degrees of freedom.[39]

Calculations based on this statistic significantly reject the null hypothesis of structural stability: $S = 39.5, P(\chi^2 \geq 39.5) < 0.001$. Since each row in the estimated transition matrix is independent of the others, the stability of each row can be tested separately, using the statistic,

$$S_i = \sum_{t=1}^{2}\sum_{j=1}^{3} \frac{n_{it}\left(\hat{p}_{ijt} - \hat{p}_{ij0}\right)^2}{\hat{p}_{ij0}}$$, which is distributed as a χ^2 with 2 degrees of freedom under the null.

Table 10 shows that time homogeneity for each row is rejected; among the three exchange rate regimes, hard peg regimes appear to be the least heterogeneous through time.

Table 10. Test of Structural Stability of the Parameters

Regime	$S_i = \sum_{t=1}^{2}\sum_{j=1}^{3} \frac{n_{it}\left(\hat{p}_{ijt} - \hat{p}_{ij0}\right)^2}{\hat{p}_{ij0}}$	P-value
Hard pegs	$S_1 = 6.83$	$P(\chi^2 \geq 6.83) = 0.033$
Intermediate	$S_1 = 12.94$	$P(\chi^2 \geq 12.94) < 0.001$
Floating	$S_1 = 19.72$	$P(\chi^2 \geq 19.72) < 0.001$

To better understand the nature of the instability, the structural stability of the diagonal and the off-diagonal components of the Markov chain can be studied separately, following Henry (1971). Markov chain can be regarded as a combination of two distinct processes: a process establishing when to change regime and a process determining the result of the shift. Instability could occur not because of time variation in all the components of the matrix, but because of heterogeneity in the diagonal components only (countries shift regimes due to changes in the feasibility of the current regime) or because of the instability in off-diagonal components exclusively (due to a time-varying attractiveness of the other two regimes). The following two hypotheses can be tested: (i) whether the transition probabilities of the diagonal components are stable, and whether the instability comes from changes in the off-diagonal probabilities; and (ii) whether the time heterogeneity derives from changes in the diagonal components accompanied with constant conditional probabilities to shift to the other two regimes. The hypotheses are tested with respect to the whole matrix and each row. The test relies on a χ^2 statistic distributed with 3 degrees of freedom (1 degree of freedom when each row is tested separately).

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[39] The degrees of freedom are given by *(T-1)*m*(m-1)*, where *T* is the number of subperiods and *m* the number of states.

Table 11. Test of Partial Stability

	H_0: stable diagonal, but unstable off-diagonal	H_0: unstable diagonal, but stable off-diagonal (conditional on leaving the regime)
Whole matrix	$S = 23.28 \quad P\left(\chi^2 \geq 23.28\right) < 0.001$	$S_1 = 16.11 \quad P\left(\chi^2 \geq 16.11\right) = 0.001$
Hard pegs	$S_1 = 6.52$ $P\left(\chi^2 \geq 6.52\right) = 0.01$	$S_1 = 0.685$ $P\left(\chi^2 \geq .685\right) = 0.407$
Intermediate	$S_1 = 0.858$ $P\left(\chi^2 \geq .858\right) = 0.354$	$S_1 = 11.97$ $P\left(\chi^2 \geq 11.97\right) < 0.001$
Floating	$S_1 = 15.89$ $P\left(\chi^2 \geq 15.89\right) < 0.001$	$S_1 = 3.45$ $P\left(\chi^2 \geq 3.45\right) = 0.063$

Table 11 shows that the partial stability hypothesis is rejected when testing the entire transition matrix. The analysis of each row separately decomposes the causes for the overall rejection: First, the null hypothesis of stability in the diagonal component of intermediate regimes cannot be rejected. In other words, the retention rate of (or the exit rate from) intermediate regimes does not appear to have changed significantly through time. The instability of the intermediate regime row, as indicated in the table, comes from the heterogeneity in the off-diagonal components: while a switch to floating is the most likely outcome in both sub-samples, the attractiveness of hard pegs has significantly increased in the more recent period.[40] Conversely, the null of homogeneity in the off-diagonal components in both hard pegs and floating regimes cannot be rejected. In other words, there is no significant difference between the direction of an exit from the two polar regimes in the two sub periods. What seems to have changed is the retention rate of these two regimes. In particular, as can be seen from Table 9, both regimes appears to have become more persistent in the second subperiod.

The evidence of a significant increase in the retention rate of the two poles points in favor of the bipolar view, since through time the extremes of the flexibility continuum appear to be more persistent. On the other hand, the insignificant change in the persistence of intermediate regimes indicates that the attraction to the two poles proceeds slowly. This suggests that the tendency of polarization does not come from an acceleration in the exit rate from intermediate regimes, but from the fact that it is now less likely to exit from the two poles.

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[40] The probability of switching to hard pegs or floating, conditional on leaving intermediate regimes is given by p_{21} / $(1 - p_{22})$ and p_{23} / $(1 - p_{22})$ respectively. Using the estimates from the two sub-matrices in Table 9, the conditional probability of switching to hard pegs has increased from 3.1 percent to 24.2 percent; the conditional probability of switching to floating regimes, has decreased from 96.9 percent to 75.8 percent.

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