



Efficient capital controls

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Rodney Schmidt

*International Development Research Centre, Government of Canada,
Hanoi, Vietnam*

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Abstract *Controls on short-term capital inflows or panic-driven capital outflows may benefit emerging markets that have fragile financial sectors and adjustable-peg currency regimes. However, the controls seen so far are relatively easy to evade, often complex and obscure, and supported by large corruptible bureaucracies. A tax on foreign-exchange payments avoids these drawbacks. It is transparent, inexpensive to set up and operate, administratively lean, and easy to adjust. A Tobin tax in effect, it is enforceable even when applied unilaterally.*

Introduction

The financial crises of the 1990s in Europe, Latin America and Asia surprised informed observers with their ferocity, seeming out of proportion to preceding macroeconomic tensions. The crises need not have happened, but arose out of a general loss of confidence and herd behaviour by panicked investors.

Once under-way, the crises presented a serious policy dilemma. On the one hand, they called for fiscal and monetary contraction and large interest-rate rises, to resist speculation, build confidence in the exchange rate, and avoid a devaluation which could undermine banks and corporations with foreign debts. On the other hand, they called for fiscal spending and monetary expansion to reflate the economy, restore domestic demand, and protect banks from bad loans. In emerging markets where international capital is very mobile and financial institutions are weak, each option may fail for want of the other, leaving the crisis to run its course.

A way out of the predicament, recently acknowledged by the G7 countries (*The Economist*, 1999), is to impose or retain international capital controls. They can be implemented either indefinitely, to prevent crises by reducing short-term inflows (Eichengreen, 1999; Rodrik, 1998; Rogoff, 1999), or temporarily, to slow panic-driven outflows (Krugman, 1999). The problem is that controls on capital outflows are not usually effective, while those on inflows may or may not be effective (Edwards, 1999; Reinhart and Smith, 1997). The controls seen so far are relatively easy to evade, especially with time and strong incentives to do so, because of the variety of financial instruments and availability of liquid secondary markets. Further, they are costly, often being complex, obscure, and supported by large and rigid administrations which lend themselves to corruption.

To avoid these drawbacks, we propose a tax on wholesale foreign-exchange payments as a control on international capital flows. Such a tax is similar in concept and effect to a Tobin tax, but is new in application. (See ul Haq *et al.*

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(1996), for a comprehensive collection of papers discussing the Tobin tax.) The difference in application is important for the following reason. The Tobin tax described in the literature would be assessed on trades of foreign-exchange instruments. It is widely agreed that this would be feasible only if the tax were imposed by the major global financial centres, at least, acting together. However, as its name indicates, the foreign-exchange-payment tax would be collected by a country's wholesale financial-payments system. In this way a country could unilaterally levy and enforce the tax on wholesale financial transactions which involved its own and one or more foreign currencies, wherever those transactions occurred.

The foreign-exchange-payment tax has the following attributes. It is:

- revenue-raising, which is useful for replenishing official reserves of foreign currency during a crisis;
- transparent, since it is uniform, inexpensive to install and operate, and needs little administration;
- selective, affecting short-term more than long-term flows, and distinguishing between the two by the actual time between inward and outward transactions, rather than by the contractual maturity of financial instruments;
- easily adjustable, to higher rates during crises or to lower rates when controls are no longer wanted; and
- effective, with limited potential for evasion by moving foreign-exchange activity offshore or by using exotic financial instruments.

The foreign-exchange-payment tax

The tax on foreign-exchange payments would be implemented in the domestic wholesale payment system of a country. This system is used to settle transactions involving exchanges of bank balances, money-market instruments, and securities. It processes payments both for domestic-financial transactions, where both assets exchanged are valued in domestic currency, and for foreign-exchange transactions, where the two assets exchanged are valued in different currencies. However, in the latter case, the system processes only the domestic-currency payment. The foreign-currency payment is made in the relevant foreign wholesale payment system.

The following two examples show how the foreign-exchange-payment tax treats domestic-financial and foreign-exchange transactions, respectively.

Domestic-financial transactions

Suppose that, in Bangkok, ThaiBank wants to buy a Thai government bond, and SiamBank wants to sell one. After the trade is agreed, ThaiBank sends a payment message to the operator of the large-value payment system, which is, let us say, the Society for World-wide Interbank Financial Telecommunications (SWIFT). The large-value payment system is the fundamental institution of the

wholesale payment system; other component institutions are described below. The message instructs SWIFT to debit ThaiBank's account at the Bank of Thailand (the central bank), and to credit the account of SiamBank, also at the Bank of Thailand. SiamBank also sends a payment message to SWIFT, to transfer ownership of the government bond to ThaiBank. SWIFT compares the two messages and requests confirmation of the exchange from the two banks. Upon receipt of confirmation, SWIFT simultaneously makes the baht payment and bond transfer. All this is done electronically and automatically. While matching the payment and transfer messages, SWIFT notes that both are valued in baht, which identifies this as a domestic-financial transaction. No payment tax is collected.

Foreign-exchange transactions

Now suppose ThaiBank telephones NYBank in New York, offering to buy dollars for baht. If the offer is accepted, ThaiBank sends a message to SWIFT to transfer baht to SiamBank, again by debiting and crediting accounts at the Bank of Thailand, because NYBank keeps its holdings of baht in an account with SiamBank. For its part, NYBank sends a message to Fedwire, the operator of the large-value payment system in the USA, to debit its dollar account at the Federal Reserve (the US central bank) and to credit the dollar account of USBank, also in New York. ThaiBank keeps its holdings of dollars in an account with USBank.

In Bangkok, SWIFT requests confirmation of the payment message from ThaiBank and, upon receipt, makes the baht payment to SiamBank. However, in the process, it cannot match the payment message from ThaiBank to another baht-valued message in the system. SWIFT therefore identifies this as a foreign-exchange transaction, and collects (as the foreign-exchange-payment tax) a percentage of the payment value for deposit in an account at the Bank of Thailand. Once again, all this is done electronically and automatically.

Institutional requirements

In these examples, the wholesale payment system has two important technical capabilities. One is that it processes individual or gross payment messages, as they arrive at the system. This is known as "continuous real-time gross settlement" (RTGS). Payment systems without this capability let messages accumulate in an "in-basket", and then process them from time to time in batches. The other is that, for financial transactions involving one currency, the system matches individual counterpart messages in order to make the two payments of a single transaction simultaneously. This is known as "payment-versus-payment" settlement (PVP) or, when a security is used, "delivery-versus-payment" settlement (DVP). Foreign-exchange transactions, which involve the domestic and a foreign currency, cannot be treated on a PVP basis, since the two currencies are normally processed in different payment systems.

These two capabilities are necessary and sufficient for the foreign-exchange-payment tax to work. As shown in the examples, they permit the payment

system to identify positively financial transactions involving only the domestic currency. They thereby also permit the payment system to identify and tax foreign-exchange transactions, since these are those that fail the PVP processing standard.

A country's wholesale payment system actually consists of two or three closely linked institutions. One is the large-value payment system featured in these examples. Another is the payment-netting system. In order to economise on the use of large-value payment systems, large banks often send payment messages to netting systems first. In the netting system, payment messages are accumulated over a few hours, and then mutually offsetting messages between groups of banks are simply cancelled. Depending on the number of participants, netting can reduce the volume and value of messages arriving at the large-value payment system significantly. Clearing-houses for securities exchanges also may be considered part of the wholesale payment system, to the extent that securities are transferred to make payments.

Because of their importance to the wholesale payment and financial systems, netting systems and securities clearing-houses are regulated by central banks. Both are required to be capable of RTGS and PVP settlement, both for financial transactions involving only one currency and for foreign-exchange transactions involving multiple currencies. Netting systems and securities clearing-houses achieve this by confirming and matching gross-payment messages associated with individual transactions before accepting them for processing (BIS, 1992; 1998; ECHO, 1998). We will discuss how central banks enforce regulations in netting systems and securities clearing-houses, whether onshore or offshore, below.

RTGS and PVP settlement technologies for domestic-financial or foreign-exchange transactions throughout the wholesale payment system mean that the tax can be collected on all gross foreign-exchange payments. These two capabilities are now standard in modern wholesale payment systems. Together, they eliminate the risk of a default on a domestic-financial payment, or "settlement risk", since both payments originating in a domestic-financial transaction are made simultaneously, or not at all. Settlement risk is important, because, in the tightly knit and fast-paced environment of modern finance, a default on a single payment may threaten the viability of the entire financial sector.

The institutions that provide an individual country's wholesale payment services often are owned separately and are geographically distant from one another. This affects how they are regulated for RTGS and PVP settlement practices. The large-value payment system belongs to or is closely supervised by the central bank and, because it supports the domestic financial system, is located within the country. At present the large-value payment systems of all of the G10 countries and many emerging markets, including most of those at the centre of the recent Asian financial crisis (Thailand, South Korea, Malaysia, Hong Kong, and China), have these features (Committee on Payment and Settlement Systems, 1997). Other emerging markets may be expected

progressively to introduce modern large-value payment systems with RTGS and PVP capabilities in order to eliminate settlement risk, especially as the volume and value of financial transactions mount. In countries with these systems the marginal cost of introducing and operating a foreign-exchange-payment tax would be small.

Formal netting systems are internationally-owned by their participants in various countries and are located offshore, usually, but not necessarily, in major financial centres. They all have RTGS and PVP capabilities, and are jointly monitored and regulated by the central banks of the member financial institutions. The central bank of the country, in which the netting system is located, plays a leading and coordinating regulatory role (Committee on Interbank Netting Schemes, 1990). As described further below, these netting systems are available for use by any mature or emerging market, and can be combined with the country's domestic large-value payment system to create an integrated wholesale payment system.

A new institutional development in the global foreign-exchange market takes this steady integration of foreign-exchange settlement institutions to its logical conclusion. A centralized global settlement bank, the Continuous Linked Settlement (CLS) Bank, will be launched in late 2001 (CLS Services Ltd, 2000). This privately-owned bank will comprise both a global large-value payment system and a multilateral, multicurrency netting system. It will operate around the clock, throughout the week, and will have direct links to domestic large-value payment systems. The purpose of the CLS Bank is to support PVP settlement of foreign-exchange transactions in domestic large-value payment systems. With the CLS Bank, participating domestic large-value payment systems, including those now in place in any emerging market, will be able to identify and tax gross foreign-exchange payments directly, by requiring payments valued in different currencies, but originating in the same transaction, to be matched and processed simultaneously, just like domestic-financial payments. This will replace the indirect method of identifying foreign-exchange payments illustrated in the previous examples, which depends on a failure to match a payment to another one valued in the same currency.

Emerging markets which do not have a modern domestic large-value payment system cannot unilaterally implement a foreign-exchange-payment tax to control international capital flows. Nevertheless, since all foreign-exchange transactions involve at least two currencies, and since the counterpart is normally a "vehicle" currency (one which by virtue of its strength or stability is a preferred medium for international transactions), the foreign-exchange-payment tax can be implemented for them by the vehicle-currency countries acting together. For example, on behalf of Thailand, the USA, the European Union, Japan and the UK could together collect the tax on all foreign-exchange transactions involving the baht on one side and the dollar, euro, yen or pound sterling on the other. Over time, as new vehicle-currencies appear, the countries corresponding to the new vehicle currencies would have to join the scheme. However, it is unlikely that such a tax on an emerging-

market currency would provide sufficient support on its own for a new vehicle-currency.

The effect of the tax

Assume for now that the foreign-exchange-payment tax is enforceable. What effect would it have on the foreign-exchange market, and on capital inflows and outflows? The main operators in the foreign-exchange market for, say, the Thai baht are the Bank of Thailand, major trading banks such as ThaiBank and SiamBank which participate continuously in the market, and their customers, who may be other banks, corporations, or insurance, pension, mutual, and hedge funds. ThaiBank and SiamBank are so-called “market-makers” in baht, because they make standing offers both to buy baht (at a bid price) from, and to sell baht (at an ask price) to, each other and also customers entering the market from time to time. In ordinary times, when the Bank of Thailand does not actively intervene, the presence of market-makers ensures that the foreign-exchange market is liquid. This means that customers expect to be able to buy or sell baht at the going rate at any time.

The bid and ask prices that ThaiBank and SiamBank post in the foreign-exchange market for baht are separated by a “spread”. This spread compensates the banks for transactions costs and for foreign exchange, liquidity, credit, and settlement risks, to which they are exposed by accommodating their customers. Further, since these costs and risks differ greatly between the wholesale and retail foreign-exchange markets, there are two such bid-ask spreads: a small one which ThaiBank and SiamBank present to each other as members of the large-value payment system, and a much larger one which they each present to their customers.

Since the tax we are discussing is paid on individual wholesale foreign-exchange payments, it is a transactions cost, just like the processing fees that are routinely collected in large-value payment systems. Thus, the tax would appear in the foreign-exchange market as an increase in the bid-ask spreads. The size of the increase depends on the net changes in costs and risks as a consequence of the tax. In ordinary times the increase in transactions costs would dominate, and would be the chief moderating influence on capital inflows and outflows. In extraordinary times, when foreign exchange, liquidity, and credit risks arising from a potential crisis become much more significant, the effect on those risks of the increase in transactions costs resulting from the tax would also become an important determinant of capital outflows.

Capital inflows

The foreign-exchange-payment tax would deter short-term capital inflows more than long-term inflows. As with a Tobin tax on foreign-exchange instruments or a Chilean deposit requirement on foreign-exchange stocks, the effective tax rate on an asset’s earnings declines as the investment horizon increases (Edwards, 1999; Eichengreen *et al.*, 1995). The payment tax would probably be more effective than either of the alternatives, however, because it is

collected on realized transactions *per se*, and is more easily enforced (see below). Controls targeted on foreign-exchange assets or on bank balance-sheets do not easily span the many different ways to execute a foreign-exchange operation, or to achieve a desired maturity structure, where derivatives and secondary markets are available.

A reduction in short-term inflows could be achieved at a low tax rate, with little negative fall-out on routine wholesale foreign-exchange activity. For example, when ThaiBank accepts a customer's order to buy or sell baht, it typically follows the order up with four or five additional transactions with SiamBank and other wholesale banks in foreign-exchange and money markets. ThaiBank does this to offset foreign-exchange and maturity risks (IMF, 1993; Lyons, 1995). ThaiBank would pay the tax on the original transaction ordered by the customer as well as on the ensuing foreign-exchange transactions. However, ThaiBank and the other wholesale banks would recover the entire cost of the tax by increasing the retail bid-ask spread facing customers. It is this increase in the spread that deters short-term capital inflows. If ThaiBank took open foreign-exchange positions on its own account, it would, of course, pay the tax itself.

Capital outflows

Slowing down capital outflows during a crisis requires temporarily more stringent controls than restraining short-term capital inflows. This is easily achieved with a foreign-exchange-payment tax, merely by raising the tax rate. It could be done either at the discretion of the government, or according to an announced rule linking, for example, the tax rate to the level or rate of depletion of official foreign-exchange reserves. The latter would be patterned on the trading "circuit-breaker" used by some securities exchanges. Alternatively, the tax or a higher tax rate could come into effect only when the interest rate, raised to defend a fixed exchange rate under attack, exceeded a threshold, or when a floating exchange rate surpassed a target zone (Spahn, 1996).

As before, an increase in the tax rate would appear as a change in the retail foreign-exchange bid-ask spread. However, in this case, it would modify an already occurring and significant increase in the spread due to rising exchange-rate uncertainty and declining market liquidity. When a crisis threatens and expectations of an imminent devaluation converge, a market-maker such as ThaiBank becomes increasingly reluctant to buy baht from customers, since it cannot easily re-sell them to SiamBank. ThaiBank compensates for increasing foreign-exchange, liquidity, and credit risks by widening the retail spread. As the crisis progresses, the spread, independent of a tax, expands until it becomes a significant factor in speculators' calculations. In the extreme, the only one still buying baht from customers is the Bank of Thailand.

During a latent crisis, the payment tax would increase the transactions-cost component of the bid-ask spread, while reducing the risk component. If people expect the tax to stop the crisis, the two offsetting changes may even result in a narrower spread than without the tax.

The case for a unilateral tax on panicked capital outflows, or on short-term capital inflows, perhaps does not extend to secular capital outflows. For example, Chile long imposed a non-interest-bearing deposit requirement on short-term assets entering the country. However, it removed the requirement when creditor countries reversed portfolio flows, including long-term capital flows, in the aftermath of the Asian financial crisis. Chile did so in order to be able to compete better against other countries for now-scarce foreign investment. Incentives for such competitive tax-rate reductions would be lessened, however, if the tax were coordinated across a broad range of countries. This would be appropriate, for example, when the primary purpose of the tax was to raise revenues rather than to control undesirable capital flows.

Enforcing the tax

Capital controls prevent currency crises only if most investors cannot evade the controls. If many investors avoid them, especially in the early stages of a crisis when expectations are more diffuse and market-makers are active, controls may actually worsen the crisis (Dellas and Stockman, 1993).

If the foreign-exchange-payment tax were implemented, could banks and non-financial institutions make foreign-exchange payments directly between themselves, without going through accounts at the central bank and without being otherwise monitored and regulated? Alternatively, could they use foreign-exchange derivative instruments to avoid making payments altogether?

Our discussion of these questions builds on three observations about the foreign-exchange market. The first is that wholesale payment systems, including large-value payment systems, payment-netting systems, and securities clearing-houses, differ from retail systems by virtue of scale-economies, technical capabilities, and services provided by the central bank. As a result, payments to settle wholesale foreign-exchange transactions cannot be made on a significant scale in the retail payment system. Even offshore wholesale payment systems must maintain close links with the central bank, entailing regulation and oversight.

The second observation is that communications technology between participants in wholesale payment systems, whether the participants or systems are onshore or offshore, is sophisticated, standardized, and nearly always provided by a single third party, SWIFT. This would make it very hard and costly to disguise or hide foreign-exchange payments on a large scale.

The third observation is that foreign-exchange derivative instruments also require payments. In most cases, these are simple payments of the principal amounts traded, just as with ordinary foreign-exchange instruments. The exception is the foreign-exchange option, which may never be executed, in which case it does not require a payment of principal. However, options are bought at a price which reflects their value, and the payment made to buy the option would be taxed. Further, the price of the option would respond to the tax, in two ways. First, the price depends on the potential for executing the

option, and the decision to execute depends on the tax. Second, the price depends on the cost of alternative, “synthetic” ways to reach the same foreign-exchange position, by buying and selling the underlying assets denominated in domestic and foreign currencies.

Private unregulated payments

Suppose that, as before, ThaiBank telephones NYBank in New York, offering to buy dollars for baht. Now, however, if the offer is accepted, ThaiBank telephones FXCorp, an imaginary non-bank financial institution in Bangkok, instructing it to transfer baht from ThaiBank’s account at FXCorp to the account of NYBank, also at FXCorp. In this way, payment of the baht leg of the foreign-exchange transaction occurs privately and internally, within FXCorp. If FXCorp processes many such payments, it is a private payment system, or “settlement bank”, for both domestic-financial and foreign-exchange transactions. Payment of the dollar leg of the foreign-exchange transaction initiated by ThaiBank occurs when NYBank transfers dollars to USBank in New York on Fedwire, as usual.

The interaction described here between FXCorp and ThaiBank as separate institutions is important. Suppose, rather, that FXCorp is a multinational corporation with branches in Bangkok and New York. Then, on the one hand, if FXCorp merely transfers baht between branches, the transfer has no impact on the value of the baht, since there is no purchase or sale of baht and no price specified. On the other hand, if the Bangkok branch of FXCorp sells baht to the New York branch in exchange for dollars, the price is arbitrary and distinct from the exchange rate in the foreign-exchange market. This is so unless the two branches normally participate fully in the foreign-exchange market for baht, and only trade with each other when it is profitable to do so, given opportunities to trade elsewhere. In the latter case, the share of purely intra-firm trading in baht would be random and small relative to trading between FXCorp and other institutions, and would have no special impact on the exchange rate.

Large-value payment systems are subject to marked economies of scale; so FXCorp is more efficient, the greater the number of its outside clients. Suppose many domestic and foreign banks and corporations keep large baht accounts with FXCorp, and continuously transfer baht between these accounts and the domestic money market, to ensure that funds are always available to make payments. Then, to minimize the number of costly transfers between FXCorp and other banks in the money market, FXCorp nets out mutually offsetting payment messages between its clients. Netting would probably become the main means of settlement at FXCorp, which would then be a private onshore netting system.

To be effective, FXCorp and its clients would have to be members of the domestic large-value payment system, operated for or regulated by the Bank of Thailand. On the one hand, formal netting and settlement systems are expensive, and are not profitable unless run on a large scale. In that case, a

breakdown or failure due to payment default would spill over into the domestic financial system. The Bank of Thailand would ensure that participants, being onshore and easy to identify, were covered by the regulatory canopy, which entails the RTGS and PVP settlement capabilities described earlier, as a condition of staying in business.

On the other hand, banks and non-financial institutions would be reluctant to use FXCorp's services on a broad scale, unless it were subject to oversight by the Bank of Thailand. FXCorp cannot confirm, match, or monitor the course of payments between itself and its clients or between clients and the domestic money market, and cannot make time-critical payments on behalf of its clients, unless it and its clients are all members of the domestic large-value payment system. These services are needed to control the aforementioned foreign-exchange, liquidity, credit, and settlement risks associated with foreign-exchange trading and market-making. Further, should a client have difficulty making a payment or default on a payment outright, FXCorp may not be willing or able to provide covering credit or make the payment good. It also may not have adequate procedures in place or the capacity to allocate resulting losses among the other clients, so as to avoid subsequent payment defaults. Finally, the Bank of Thailand might not be inclined to extend emergency liquidity, unless FXCorp adhered to its regulatory and supervisory regime.

These considerations underlie the existing large difference in bid-ask spreads between the retail and wholesale foreign-exchange markets. Given the great volume and highly competitive nature of foreign-exchange trading in the wholesale market, it is unlikely that FXCorp or similar institutions could operate on a large scale in the retail market, even if they could escape Bank of Thailand regulations, for example, by moving offshore.

Offshore payments

What if, instead, ThaiBank and NYBank, after agreeing to exchange baht and dollars, both send their respective payment messages offshore to FXNet, a hypothetical international wholesale payment netting system? Is FXNet, or, equivalently, an offshore securities exchange dealing in securities denominated in different currencies, beyond the regulatory reach of the Bank of Thailand?

As with FXCorp, to operate effectively FXNet must have close ties to the Bank of Thailand and the baht large-value payment system. The reason is that ThaiBank and SiamBank do not keep large balances of baht offshore. Rather, they keep them at home, where there is easy access to the liquid domestic money market, the large-value payment system, and the services of the Bank of Thailand. Thus, ThaiBank and SiamBank are members of the domestic large-value payment system and, to facilitate continuous and reliable payments between them and FXNet, the latter must also have direct access to the large-value payment system, via an account with the Bank of Thailand. Even if an offshore market in baht were to arise, actual baht balances underlying the market would be kept in Thailand, in intermediary or "correspondent" banks,

which are members of the large-value payment system, just as dollar balances underlying the Eurodollar market are held in such banks in the USA.

The ability of central banks to regulate offshore netting systems, and the willingness of netting systems to cooperate, derive from these institutional links. Regulations governing offshore netting systems have been formalized in an international protocol, the Lamfalussy Minimum Standards (BIS, 1998; Committee on Interbank Netting Schemes, 1990). They encompass, in this case, the legal status at home of baht payment messages processed by FXNet, measures to reduce settlement risk, safeguards against default, and a “lender of last resort” role for the Bank of Thailand. Only members of the baht large-value payment system have access to FXNet. since, if FXNet were to fail, participants’ viability would be at risk, as would be the domestic financial system.

A contemporary case illustrating these points is the private Exchange Clearing House Organization (ECHO), a large multilateral netting system based in London. It is regulated by the Bank of England in consultation with other interested central banks (CLS Services Ltd, 1998). To process a new currency, ECHO requires approval from the relevant central bank:

We [ECHO] therefore need to work very closely with the local regulators on understanding how the local payment system works and to know the law on netting . . . The central banks have agreed that trades in their respective currencies may be settled within the system and that the rules, operational structures and systems of ECHO are appropriate to their national markets (*ECHO*, 1998).

Central banks enforce regulations in offshore netting systems by making the necessary institutional links between them and the domestic large-value payment system conditional on compliance. For example, the Federal Reserve published the following policy in this regard:

To enforce these regulations, the Federal Reserve reserves the right to prohibit the use of Federal Reserve payment services to support fund transfers that are used to settle, directly or indirectly, obligations on large-dollar multilateral netting systems that do not meet the Lamfalussy Minimum Standards . . . no future or existing privately operated large-dollar multilateral netting system will be permitted to settle on the books of a Federal Reserve Bank unless its participants authorize the system to provide position data to the Reserve Bank on order (Federal Reserve, 1994).

Thus, central banks can enforce a foreign-exchange-payment tax, in offshore systems that are netting payments of the domestic currency, by refusing to process or settle payments between non-cooperating systems and either the domestic money market or the large-value payment system. They can also impose less onerous sanctions on members of the domestic large-value payment system that participate in non-cooperating offshore netting systems.

What about informal small-scale payment-message netting between small groups or pairs of banks, either onshore or offshore? By definition, activity of this kind to avoid a foreign-exchange-payment tax would be limited in scope. In any case, for regulatory and tax purposes, it is relatively easy now to access gross-payment messages submitted for netting at any scale. This is because

most netting, whether in formal systems (including ECHO) or informally between *ad hoc* groups, is done by SWIFT, which also provides the standard communications network between banks, as well as between banks and netting and large-value payment systems (BIS, 1993; Perold, 1995). SWIFT is pervasive because it is cost-effective to have such sophisticated services provided by a central third party, and to standardize those services in order to achieve an automated and seamless interface between all participants in the domestic-financial and foreign-exchange payment systems. SWIFT's dual function as a virtual netting and interbank communications system enables automatic and electronic recording of the course of payment messages from submission by individual banks, through a netting system, and finally on to the large-value payment system (ECHO, 1998). SWIFT also performs these services for exchanges of bank balances and securities.

Derivatives

The foreign-exchange-payment tax does not discriminate between off-balance-sheet foreign-exchange transactions, such as those involving derivatives, and on-balance-sheet transactions. All are taxed as long as they involve payments between parties to the transaction. Most, by far, of the foreign-exchange derivatives in use today, such as outright forward and swap contracts, require simple payments of the currency amounts exchanged, just like ordinary foreign-exchange instruments. The exception is foreign-exchange options contracts, which are not always executed and therefore not always followed by a payment of the principal specified in the contract. However, options contracts have to be bought, and so a payment has to be made for the value of the contract.

The impact of a foreign-exchange-payment tax on foreign-exchange options would be revealed by a change in the price or, equivalently, the value of the option. This price coincides with the expected profit from taking an open position, or the expected loss avoided by hedging an open position. The tax would affect these expectations both directly and indirectly. The direct effect is twofold. First, the tax would be paid on the payment made to buy the option. Second, since the tax is paid on the principal if the option is executed, the tax affects the decision to execute, and, thereby, the price of the option.

The indirect effect of the tax on options prices would occur via the arbitrage relationship between the option and its equivalent in the underlying asset markets. A derivative contract can always be synthetically duplicated by transactions in the spot or forward foreign-exchange market, in combination with parallel transactions in the domestic money markets of each of the two currencies. These transactions would be taxed, as usual. Thus, arbitrage by major foreign-exchange trading banks, entailing both purchases of derivative contracts and execution of their synthetic equivalents (but not necessarily in a one-to-one ratio), ensures that both methods of achieving a given foreign-exchange position are equally valued, after accounting for differences in transactions costs, including the tax. Indeed, the more complex options are

deliberately priced on the basis of this arbitrage relationship, which would incorporate the effect of the payment tax.

Conclusion

The major financial and currency crises of the 1990s, including the attacks on the European Union's Exchange Rate Mechanism in 1992/1993, on Mexico in 1994/95, and on Southeast Asia and Latin America in 1997-1999, all involved fragile financial sectors, internationally mobile capital, and adjustable-peg currency regimes. They also all contained elements of contagion and self-fulfilling panics. These events justify serious consideration of capital controls in emerging markets.

Experience with capital controls is, however, equivocal. They are administratively burdensome, abused by vested interests and open to corruption, self-perpetuating beyond their usefulness, and often ineffective. Thus, many informed observers view capital controls sceptically at the outset, and turn attention to them only reluctantly.

The foreign-exchange-payment tax should allay many of these concerns. We have argued that it is an efficient control on international movements of capital. It is watertight and, because it depends on existing institutional infrastructure in the foreign-exchange market, it is not expensive to implement. It carries few of the ancillary microeconomic costs listed above. Most importantly, it seems likely to be effective in restoring monetary, fiscal, and exchange rate policies to good use, until such time as the financial sector and economy as a whole are robust to free international capital flows.

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