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"World Bank Capital Neither Complements nor Substitutes for Private Capital"

By Michael A. Clemens

Abstract

What should the World Bank optimally do with the US$10 to $20 billion it can loan each year? Has it, in fact, done what is optimal? These two questions, one theoretical and one empirical, have been around for a long time and remain controversial in both academic and policy circles. This study seeks to contribute to the debate by suggesting a simple framework within which to measure the World Bank against an optimal international public financier for development. It goes on to argue that a careful treatment of the empirical evidence on Bank lending strongly contradicts optimal behavior under different assumptions. The evidence, in fact, rejects any notion that the Bank has substituted for private capital or that it has successfully catalyzed private development finance. These questions of fact are separate from the normative issues of whether to "mend" or "end" the current system of multilateral development finance.

World Bank capital neither complements nor substitutes for private capital[1]

by

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I
Introduction

What should the World Bank optimally do with the US$10 to $20 billion it can loan each year? Has it, in fact, done what is optimal? These two questions, one theoretical and one empirical, remain controversial in both academic and policy circles. This study seeks to contribute to the debate by suggesting a simple framework within which to measure the World Bank against an optimal international public financier for development.

The economic justification for public finance of any kind is that it eliminates inefficient production or allocation due to market failures such as externalities. We thus require a vision of why the international private capital markets provide so little investment to poor countries before we can explore optimal international public finance for development. When Lucas (1990) famously asked why capital does not flow from rich to poor countries if the marginal product of capital in those countries is as high as predicted by a neoclassical production function,[3] he set the stage for this exploration. Here we call the pattern of rich countries receiving the lion's share of international investment by the name *wealth bias*.

Theoretical explanations of wealth bias have fallen into two groups, each suggested by Lucas. In rough terms, either the marginal product of capital is very high in poor countries but a failure of the international capital market prevents capital from going to those countries, or marginal product of capital as realized by any investor (domestic or foreign) is not high in the developing world. This last could be due to either fundamentally different production functions in developing countries—due to endowments of an immobile third factor—or domestic market failures that prevent all investors from realizing high returns.

[3] Others besides Lucas—though not as often cited—who raised the issue around the same time include Barro (1991), Gertler and Rogoff (1990), and King and Rebelo (1993).

For an optimal international public financier it is crucial which theory is correct. If the marginal product of capital is high in developing countries but (say) cross-border informational asymmetries prevent private finance from exploiting those returns, the public financier increases the efficiency of capital allocation by substituting for missing private capital flows. If in fact the return realizable by any investor in developing countries is low, then such filling of a 'financing gap' by the international public financier can only create debt crises; if marginal product of capital were high enough to pay those loans, the private market would have provided them. In this case, the public financier can only complement or catalyze private capital—not replace it—by helping resolve the domestic market failures that depress the realized marginal product of capital. Thence comes the question of whether international or domestic market failures are the root of wealth bias, whose answer suggests whether the optimal financier replaces or catalyzes private investment. The next logical step is the empirical question of whether the World Bank has historically replaced or catalyzed private capital flows.

This issue is hardly confined to academic circles. African heads of state have encouraged expanded aid flows and publicly posited that the marginal product of capital is "30 to 35 percent" in Africa, but that informational asymmetry prevents foreigners from exploiting it.[4] To the contrary, a World Bank research department study suggests that neither private nor public investment is productive in Africa (Devarajan, Easterly, and Pack 2001) and Bank President James Wolfensohn says the role of his organization should be to "catalyze—not replace—private investment flows" (World Bank 2000). While Kofi Annan calls for doubling of foreign aid for development and the World Bank insists on the effectiveness of that money (World Bank 2002), some economists lament that aid is unproductive and has done little to create the conditions for high capital productivity (Dapice 2002). The US Congress' International Financial Institution Advisory Commission, headed by Alan Meltzer, recommended in 2000 that the

[4] "Where in the world do you get a 30 to 35 percent return on investment? These people they sit down in London, Paris, New York and Brussels and do risk assessment reports based on reports from people who know little or nothing of Africa. Look at the number of enterprises that failed in the developed countries and look at the number that failed in Africa. What risk are you talking about?" –Nigerian President Olusegun Obasanjo, quoted in the *World Bank Development News*, April 17, 2002.

multilateral development banks be dramatically downsized and "transformed from capital-intensive lenders to sources of technical assistance, providers of regional and global public goods, and facilitators of an increased flow of private sector resources to the emerging countries." In other words, aid should be reduced and focused on increasing the marginal product of private capital, rather than expanded to substitute for that capital. This raging policy debate on the extent and focus of continued aid, like its academic counterpart, hinges on whether international capital market failure or low productivity is the reason necessitating aid in the first place.

In the past, bilateral foreign aid has often gone to countries with historical, political, or military ties to the donor—criteria often unrelated to capital productivity (Alesina and Dollar 2000)—in spite of corruption (Alesina and Weder 1999). The relative political independence of the World Bank offers it an opportunity to act in closer accord to optimal public finance (Rodrik 1996). There is mounting evidence that the political and institutional environment in borrower countries greatly affects the productivity of foreign aid (Isham and Kaufmann 1999; Dollar and Pritchett 1998; Devarajan, Dollar and Holmgren 1999). Unproductive aid loans lead to large debts, and large debts crowd out desperately needed domestic investment (Cohen 1993).

The question of how the World Bank should make loans, then, takes on urgency. We will look for clues to answer this question in the patterns of how it *has* made loans. Section 2 motivates the question by tracing a half century old debate on the proper role of the Bank. Section 3 reviews previous research on the interaction of international public finance and private capital flows to developing countries. Section 4 uses a simple model to derive testable predictions for the behavior of the optimal international public financier under different assumptions. Section 5 motivates the empirical framework used to test those assumptions, while Section 6 explains a research decision involving the impulse response functions. Section 7 presents and discusses the empirical result that under no assumptions has the World Bank acted as the optimal public financier. Section 8 concludes.

II
Fifty Years of Debate on the Role of the World Bank: White vs. Keynes redux

Policy debate over whether the World Bank should replace or catalyze private capital flows began at its founding and has continued unabated. This section traces the origins of the debate on whether the proper role of the World Bank should be that of a complement or substitute for private capital. The tension between these goals has continued, largely unabated, through each of the six decades since the Bank was conceived.

US Assistant Secretary of the Treasury Harry Dexter White prepared the earliest written plans for an "International Bank" between 1941 and 1942. He and his superior, Secretary Henry Morgenthau, clearly intended the Bank to replace private foreign capital flows that were economic but not forthcoming. Both Roosevelt-appointed New Dealers, they had watched the pre-1914 boom in cross-border private capital flows collapse during interwar chaos and were wary of the market's vagaries. Morgenthau's often-quoted goal was "to move the financial center of the world from London and Wall Street to the United States Treasury," conceiving the Bank as the domain of "sovereign governments and not of private financial interests" in order to "drive … the usurious money lenders from the temple of international finance" (Gardner 1980, p. 76). White "regarded the imperfections in the private investment market as being so important as to make it a poor guide for internationally financed capital formation" (Oliver 1975, p. 121).

In White's first draft of the proposal for what would become the World Bank, it was designed chiefly to supply the huge volume of capital to the United and Associated Nations that will be needed for reconstruction, for relief, and for economic recovery. … To supply this capital at rates of interest low enough with a period of repayment long enough to give the borrowing country reasonable hope of being able to repay the loan, is the prime task and justification of a Bank of the character described in this report. (Gardner 1980, p. 84)

By implication, the private market was providing neither the requisite "volume" of capital nor "reasonable" terms of credit, and the Bank would step in as a substitute. The uncoordinated international economic policy free-for-all of the 1930s had convinced him that unilateral action could not achieve this goal (Oliver 1975, p. xvii).

Republican politicians and Wall Street soon voiced concerns about the interventionism of White's early proposals. New York bankers wondered if "a system that permitted other countries to control capital movements might prevent the rebuilding of an open, liberal international financial system from which they, as [the] world's leading bankers after the war, would derive considerable benefit" (Helleiner 1994, p. 39). In Congressional hearings on the bill authorizing US membership in the Bank and International Monetary Fund, Representative Robert A. Taft of Ohio led the fight to limit the role of government in the new postwar international financial architecture. He decried the plan as "part of the general New Deal program to create new methods of deficit spending," while his colleague Frederick C. Smith suggested they were "part of a British plot to seize the gold of the United States" (Oliver 1975, p. 159). Taft insisted that only private banks had the wisdom and experience to make international loans (Mikesell 1994, p. 43). A New York Times editorial of December 1942 summarized the conservative view, uncannily anticipating points of debate from over half a century later:

If a loan seems really sound—so sound that private investors would voluntarily risk their own money in it—why should it not be left to such investors? People are far more likely to be careful in lending their own money than in lending other people's money. It is no reply to say that many bad private foreign loans were made after the last war; the record of repayment is at least incomparably better for these than for Government loans, most of which should probably have been gifts! … Under the proposed plan for a World Bank American taxpayers would make loans to foreign Governments whether or not these taxpayers individually considered the loans to be sound. If the creditor Governments had no control over the internal economic and fiscal policies of the debtor Governments to which they made loans, they might be pouring

their taxpayers' money down a bottomless pit. If, on the other hand, the creditor Governments did insist on control over the internal policies of the debtor Governments, there would be more sources of international friction and bitterness.

The chief economic need of the postwar world is not new governmental super-machinery. It is the return by individual Governments to policies under which a restoration of international confidence and private international lending will be possible. (Oliver 1975, p. 160)

The 1944 United Nations Monetary and Financial Conference at Bretton Woods, New Hampshire, formally established the Bank. In negotiations leading up to the conference, British government representatives under John Maynard Keynes and Redvers Opie also pushed for a much more limited Bank than Morgenthau and White envisioned. The British view was that "[m]ember nations should make only token contributions to the Bank. They would have quotas which could be called upon if needed to cover the Bank's obligations, but the Bank would not make loans of its own funds; it would guarantee loans arranged through its auspices but floated in private investment markets" (Oliver 1975, p. 151). A contemporary biographer of Keynes put it with greater flair: "It was Keynes who had to fight the battle of liberalism against the voracious appetite of the Americans for paternalistic interference. Keynes thought of the international institutions as setting up a framework within which individual initiative could flourish. … The Americans wanted to give meticulous scrutiny to each individual transaction. In all this long-drawn-out conflict it appears that Keynes was fighting for the philosophy of freedom against the philosophy of regimentation" (Harrod 1951, pp. 570-1). Clearly Keynes' vision was that of a Bank that would catalyze and complement, but in no way replace, private finance.

This conflict caused White's team to retreat a bit as Bretton Woods approached and the final agreement for the Bank achieved somewhat of a compromise between the two views. In the weeks leading up to the conference, White softened his stance as he testified to a skeptical US Congress that "the post-war problem of international

investment is to assure an adequate flow of private capital for productive purposes. This can be done only be aiding and encouraging private investors to provide capital through the usual investment channels" (Oliver 1975, p. 212). The main Articles of Agreement of the International Bank for Reconstruction and Development (IBRD), adopted in 1944 and reigning still, laid out a dual role in which the Bank would both substitute for private capital with its own loans as well as catalyze foreign capital with loan guarantees. The bipartite role is clear from Article I, which emphasizes the Bank's role as a complement for private capital but admits a subordinate role as a substitute. It states that the Bank must "promote private foreign investment by means of guarantees or participations in loans and other investments made by private investors; and when private capital is not available on reasonable terms, to supplement private investment by providing, on suitable conditions, finance for productive purposes out of its own capital, funds raised by it and its other resources."

Article III insists that the Bank must only loan if it "is satisfied that in the prevailing market conditions the borrower would be unable otherwise to obtain the loan under conditions which in the opinion of the Bank are reasonable for the borrower." On the other hand, it must also "pay due regard to the prospects that the borrower … will be in position to meet its obligations under the loan." That is, the Bank must replace private capital that is not forthcoming, but must loan only to countries that can repay the loan. It must loan to those that cannot borrow but can repay. This is antinomy for certain countries—those that can neither borrow nor repay, and those that can repay but can also borrow on private markets under "reasonable" terms.

In such countries, the compromise of White and Keynes becomes an ineluctable tension between conflicting aims. On one hand Article III implicitly requires the Bank only to loan in cases of international capital market failure; without failure, the private market would lend to those with the ability to pay, and no country would meet the conditions therein. On the other hand the emphasis placed by Article I on 'promoting' investment before performing investment clearly presumes that such market failures are minor and that private capital, if encouraged, will flow and need not be replaced.

Both conditions are open to interpretation. When does a country have access to private credit on "reasonable" terms? Who determines whether or not a country can "meet its obligations"? The Bank's charter left open to debate the question of whether it should focus on complementing or replacing private capital flows to any given country. At Bretton Woods, the delegate from El Salvador tellingly proposed that the new bank be named either "The International Guarantee and Investment Association" or "The International Investment and Guarantee Association" (Oliver 1975, p. 183).

This tension, unresolved at Bretton Woods, would continue throughout the history of the Bank. Immediately after the conference, Republican Congressman Charles Dewey led the fight against ratifying US participation in a Bank that would make large loans out of American coffers (Oliver 1975, p. 211). Democratic President Truman, on the contrary, proclaimed that "the International Bank will assume the primary responsibility for meeting the world's international capital requirements that cannot be met by private investors on their own account and risk" (Gardner 1980, p. 291).

As the fledgling Bank passed from the 1940s to the 1950s, Bank policy leaned decidedly in the direction of complementing rather than substituting private capital. Three former Wall Streeters—John McCloy, Robert Garner, and Eugene Black—were appointed to Bank leadership. This "victory for the more conservative elements in the United States" gave "the Bank the reputation of being more concerned with protecting the interests of their former clients in New York—purchasers and underwriters of the Bank's bonds—than with actively pursuing the development of their new clients—the less developed countries of the world" (Oliver 1975, pp. 237-238). To these managers, the Bank was "a temporary institution set up for a supplementary role" recognizing "the primacy of foreign private investment, and the role of the Bank was seen as to assist in restoring and possibly speeding-up the time when prospective borrowers would be able to raise funds in the international capital market as and when needed. Once that state of affairs had been reached the Bank was thought in some circles to have fulfilled its role" (van de Laar 1980, pp. 35-36). A World Bank (1954, pp. 111-112) staff report during

this period emphasized that "Bank loans in the Rhodesias and the Belgian Congo … are obviously promoting a continuation of the private capital inflows which have recently been playing such a large part in the development of those areas. … Bank [credits] throughout Latin America have doubtless contributed significantly to the process of industrialization which is now gaining momentum there, financed in part by private foreign enterprises."

As the 1960s began, the pendulum swung towards the Bank's role as a substitute for private capital. Many of its relatively wealthy European client countries graduated from borrower status and were replaced by a wave of impecunious newly independent developing countries. The Bank saw in this period its first serious problems with loan arrears (Kapur et al. 1997, p. 945). Tension between the Bank's dual roles had led to the creation of a new agency, the International Development Association (IDA), loaning exclusively to countries with neither the ability to borrow on private markets nor the ability to pay on standard Bank terms. "Pre-IDA analysis of creditworthiness was more or less stood on its head by the advent of IDA. Until then, economists wrote their economic reports to demonstrate that countries were creditworthy and thus qualified for Bank loans. In 1961, the desire was to show that countries were not creditworthy and thus they qualified for IDA credits" (Mason and Asher 1973, pp. 400-401). To IDA, then, fell the unambiguous role of replacing private capital. The IBRD would redouble its focus on complementing private finance, since charging concessional rates could "blunt the Bank's efforts to get the higher income borrowers to go to the market" and "adversely affect the Bank's market image" (Kapur et al. 1997, p. 937). Bank President Eugene Black continued to promote the role of Bank technical assistance and other non-financial influence in raising the productivity of private capital, insisting that "the shortage of capital is not the only, and indeed not the principal obstacle, to more rapid economic progress in the less developed countries." He saw the IDA as loaning, at levels far lower than the IBRD, "in lieu of the market" (Oliver 1975, p. 266).

Under President McNamara, the Bank of the 1970s greatly increased its lending capacity by shifting from dependence on government transfers to leveraging its paid-in

capital and reputation to raise funds on private markets. This pulled the Bank in two conflicting directions. On one hand McNamara's goal in the credit expansion was to attack poverty, even if that meant aggressively substituting for private capital. One of McNamara's deputies reported that the new chief, on taking office, was "shocked to find we don't help the poorest because Bankable projects [are] not suitable for them" (Kapur et al. 1997, p. 222). On the other hand, the Bank's increasing reliance on private bond issues to finance its lending required it to signal private markets of the creditworthiness of its loan portfolio lest it face exorbitant borrowing costs of its own (Kapur et al. 1997, pp. 1027-1028). The Republican-led American Congress, in light of the Bank's expansion and facing domestic stagflation, balked at the 1971 replenishment of IDA and temporarily defeated the 1974 replenishment in an unprecedented battle (Oliver 1975, p. 265). The pressure was on McNamara, both from Wall Street and from the US capitol, not to slip too far into the role of substitute for private capital.

We observe the same dichotomous pressures advancing through the 1980s. Financial turmoil stemming from widespread debt default in the developing world placed the Bank's AAA bond rating at risk to the extent that it were to step in and replace strangled private capital flows to those areas. At the same time, newly elected conservative heads of state in the United States, Britain, and Germany were "signalling less commitment to poverty" (Kapur et al. 1997, p. 338). Reagan's Treasury Undersecretary Beryl Sprinkel commissioned a study recommending decreased US participation in the Bank and urging the Bank to use conditionality and technical assistance to foster greater reliance on private capital, implicitly inveighing against replacing such capital. The American share of the Bank's paid-in capital fell by a third in the 80s (Gwin 1997, p. 230, 244). Nevertheless, the drying up of financial flows to LDCs created strong political pressure to reach out to countries without access to private finance and to increase concessionality. In 1984, the Bank for the first time reversed its earlier de facto policy of refusing to reschedule debt when it placed Nicaragua in "nonaccrual" (default) status. In 1986, Romania and Peru followed (Kapur et al. 1997, p. 1059). Pressure mounted to use IDA funds to "bail out the Bank" (Kapur et al., 1997, p. 1067).

Entering the last decade of the 1990s, a dramatic upswing in international private investment saw the ratio of World Bank capital flows to private flows destined for developing countries fall from fifty to under five percent over just seven years (Kapur et al. 1997, p. 1108). Increasing transactions costs of Bank loans such as its new system of environmental impact review, combined with plentiful private finance, led to a stagnation in Bank credits. Republican policymakers have urged against replacing private capital, suggesting that the Bank dramatically scale back its lending to countries with access to private credit (e.g. Schaefer 2000). While Bank President James Wolfensohn agrees that in a world of massive private flows the Bank's primary role is that of a "catalyst" for private investment (Wolfensohn 1997a), he also stresses repeatedly that the lion's share of private finance reaches only a handful of developing countries (e.g. Wolfensohn 1997b). This latter point carries the clear implication that the Bank must step in to carry out the unfinished business of the private sector. The United Nations "Monterrey Consensus" of 2002 agrees that the Bank must replace private finance, stressing that "[m]ultilateral … development banks … should contribute to providing an adequate supply of finance to countries that … may lack access to capital markets." But leading NGOs continue to stress the role of multilateral lending as a "catalyst for private capital," since these loans often "create a climate for increased private investment in more commercially active sectors" (Birdsall 2001). The tension between complementing and substituting for private capital persists. In different words, the magisterial survey of Bank history by Kapur et al. (1997, p. 1111) agrees:

Though the Bank's financial and development personas have always been inextricably linked, there have been periods in which their coexistence has been more competitive than complementary. The tension between institutional policies and practices thought to advance pressing development objectives on the one hand, and the vital need to project the image and reality of financial probity on the other, has been a recurrent theme in the Bank's history, albeit of varying intensity.

III
Previous Research

A formidable body of empirical research has focused on the ability of the World Bank's international public finance to promote private domestic investment incentives (Dollar and Easterly 1999, Isham and Kaufmann 1999), good policies (Dollar and Pritchett 1998, Dollar and Svensson 2000), growth (Burnside and Dollar 2000), and poverty reduction (Easterly 2001).

There has, however, been only very limited study of the interaction of World Bank and private capital flows to developing countries. The first study appears to be Rodrik's (1996). He concludes that, with five-year periods, once-lagged multilateral lending is negatively but not statistically significantly associated with current private capital flows, and that once-lagged private flows are positively associated with current multilateral loans. While he includes dummies for country groupings based on income and indebtedness, this leaves open the possibility that unobserved country-level fixed effects bias his results. Furthermore, the simple time series structure he employs leaves open questions of causality and sensitivity of the results to lag choice. While describing these results as preliminary, he recommends that the Bank shift its emphasis from "lending" to "monitoring and informational activities." Bird and Rowlands (2000) similarly find that one-year-lagged World Bank lending is negatively and significantly associated with private capital inflows, but the strength of their conclusions is subject to similar limitations. The present work avoids arbitrary selections of functional form and lag length within an explicit theoretical framework, and takes on the issue of causality in order to reach much stronger conclusions.

The unpublished work of Dasgupta and Ratha (2000) at the World Bank Development Economics Prospects Group question Rodrik's results directly. They use a simple regression framework with private capital on the left-hand side and a suite of variables including one-year-lagged World Bank credits on the right-hand side. They

conclude that a positive effect "seems to be present" and that the World Bank has therefore successfully catalyzed private capital flows, but this effect is not significant at the 5% level. They also present evidence that, on the very short term, year-to-year World Bank disbursements and private capital inflows are countercyclical. An important limitation of this work is its implicit model of very short term relationships between private and public capital, ruling out effects that endure past one year, and its atheoretical empirical framework. No causal inference is possible. The present study addresses all of these issues.

Ratha's (2001) unpublished work uses five-year periods to extend the above work, finding that once-lagged share of total multilateral development lending received by a country is positively and significantly associated with share of total private portfolio capital. He also finds that *current* share of multilateral lending, in low-income countries, is *negatively* and significantly associated with share in private flows. From this evidence, he concludes that "[e]ven though multilateral loans may have behaved counter-cyclically vis-à-vis private flows in the short term, these loans tended to complement private flows in the medium term… ." A lack of time series analysis, however, weakens this conclusion. Does the positive lagged coefficient on multilateral lending show multilaterals catalyzing subsequent portfolio capital (i.e. the World Bank complements private capital) or is it a reflection of the same countercyclical lending he posits for the current period and private flows have simply increased since the previous period (i.e. the World Bank substitutes for private capital)? Although expansion to five-year periods potentially captures longer-term effects, by retaining an extremely simple time series structure the study precludes effective causal inference.

The present work brings to bear on the question a clear optimal public finance framework and more subtle econometric techniques in a richer time series framework, allowing inference on the direction of causation. Its contribution is to frame the debate in theory and provide strong evidence that the World Bank has not been playing the role of an optimal international public financier since 1970—a positive, not normative, conclusion.

IV
A Simple Model

Production takes place according to $y = k^{\alpha}$, where y is per capita output, k is total capital stock per capita, and α is the capital-labor ratio. We abstract away from population growth and technological change over time. Developing country residents choose a dynamic consumption path to maximize constant intertemporal elasticity of substitution utility in present value,

$$\underset{c_t \forall t}{\text{MAX}} \int_0^{\infty} \frac{e^{-\rho t} c_t^{1-\sigma}}{1-\sigma} dt \,, \tag{1}$$

where ρ is the rate of time preference and $1/\sigma$ is the intertemporal elasticity of substitution. Consumers are subject to the constraints that any unit of the capital stock is either owned by domestic residents or by foreigners, and that domestically owned capital is savings from output less payments on foreign debt. That is,

$$k_t = k_{d,t} + k_{f,t} \text{ and} \tag{2}$$

$$\dot{k}_{d,t} = k_t^{\alpha} - r k_{f,t} - c_t \,, \tag{3}$$

where $k_{d,t}$ is that portion of total capital owned by domestic residents at time t, the portion owned by foreign residents is $k_{f,t}$, the world interest rate is r, and a superimposed dot indicates the derivative with respect to time. Maximizing the current-value Hamiltonian reveals that at the steady state (where the growth rates of c_t and $k_{d,t}$ are equal),

$$\frac{k_{f,t}^*}{y_t} = \frac{s\sigma - \alpha\left(1 + \frac{r-\rho}{m}\right)}{r\sigma - (m + r - \rho)} \,, \tag{4}$$

where $m_t = \alpha k_t^{\alpha-1}$ is the marginal productivity of capital, $s_t = 1 - (c_t/y_t)$ is the saving rate, and the lack of a time subscript indicates steady-state value. Since the integrand of (1) and the right-hand side of (3) satisfy Mangasarian's sufficiency conditions of concavity and differentiability, and assuming a transversality condition that the shadow value of capital approaches zero at $t \to \infty$, then (4) must give the *unique* efficient long-run ratio of foreign capital to GDP.

Noting that $\frac{\partial\left(k^*_{f,t}/y_t\right)}{\partial m} > 0$ and $\frac{\partial m}{\partial k} < 0$, we predict that $\frac{\partial\left(k^*_{f,t}/y_t\right)}{\partial k} < 0$. (5)

That is, efficiency requires that poorer countries receive more foreign investment—all else equal. A similar prediction was the motivation for Lucas to ask why capital does not flow *en masse* from rich to poor countries. We do not observe anything close to (5) in the International Monetary Fund data on private capital flows displayed in Figure 1, which graphically displays the puzzle discussed by Lucas. Why? Equation (4) immediately suggests two potential reasons. First, an international credit constraint specific to poor countries could place exogenous limits on k_f in those countries. Alternatively, poor countries might face a fundamentally different production function than rich countries or domestic market failures that abrogate realized returns for all investors foreign and domestic (e.g. $y = \phi k^{\alpha}$ where $0 < \phi < 1$), such that in fact m is lower in poor countries.

To an omnipotent social planner seeking to maximize the efficiency of global capital allocation, it matters greatly which of these two forces is in fact responsible. If an international credit constraint specific to poor countries prevents (4) from holding with equality, the social planner could increase global efficiency by transferring capital from rich (low m) countries to poor (high m) countries. It would continue to supplement privately-held k_f^p with publicly-held k_f^a until equality (4) obtained (where a stands for "aid", and $k_f = k_f^p + k_f^a$). Holding constant all parameters on the right-hand side of (4), efficiency would require the planner to respond to any decrease in k_f^p/y with an exactly commensurate increase in k_f^a/y.

This is not at all true if the reason for low k_f/y in poor countries is that of generally lower m in those countries, such that (4) holds with equality and the private capital market already allocates capital efficiently. In this case, any supplementation of k_f^p with k_f^a lent at interest rate r would drive the recipient country off the optimal manifold. Artificially supplementing k_f^p in this fashion would retard growth according to (3), either necessitating impoverishment (reduced c_t) or debt crisis (a unilateral write-down of

k_f^p or k_f^a) or both. In rough terms, m is not high enough to pay r.[5]

A simple model has, then, very different implications for optimal international public finance to developing countries in accordance with the root cause of low k_f. If k_f is low due to failures in the international capital market, the social planner must react to a decrease (increase) in k_f^p/y with an equal increase (decrease) in k_f^a/y. This predicts that a negative shock to k_f^p/y will be followed by a positive shock to k_f^a/y, and that k_f^p/y should not respond to past shocks in k_f^a/y. Shocks to both k_f^a/y and k_f^p/y should be unrelated to shocks to k_d/y.

If on the contrary the dearth of k_f in poor borrower countries owes itself to lower m in those countries than in their rich counterparts, the only way for the social planner to raise the poor recipient's utility is to change the parameters of the problem. To the degree that the social planner can use lending to influence ϕ,[6] it can increase $m = \phi\alpha k^{\alpha-1}$ and thereby increase the value of (4). Of course, increasing the marginal productivity of capital would also increase investment incentives for domestic residents and increase k_d^*/y. This suggests that past positive shocks to k_f^a/y would be followed by positive shocks to both k_f^p/y and k_d/y. Past shocks to k_f^p/y would be unrelated to later shocks to k_f^a/y, but would be positively correlated with shocks to k_d/y.

Table 1 summarizes these predicted correlations. Predictions that differ between the cases with and without international capital market failure are indicated in gray.

Said differently, a social planner seeking efficiency in a world with international capital market failure would provide poor countries with public capital to substitute for private capital. The same social planner in a world without international capital market failure would complement private capital with public capital. Below, we observe the

[5] The Social Planner may have distributional motives, but as long as market interest rate r is charged on the loans, the same impoverishment or debt crisis will result. If r is charged, *any* lending criterion besides efficiency stunts growth or leads to default in the borrowing country.

[6] It could do so through making loans conditional on policy reforms that increase m, targeting investments that reduce domestic market failures, and so on.

behavior of the World Bank over the last three decades to see if it holds clues to 1) whether developing countries face credit constraints or low marginal productivity of capital, and 2) whether or not the World Bank has been the optimal international public financier for developing countries.

V
Empirical Method

The dynamic properties and theoretical ambiguity of the model suggest a time-series approach with minimal assumptions regarding functional form. For simplicity, we focus for a moment on the relationship between privately-held foreign capital flows and World Bank capital flows. Because both types of flows are potentially endogenous, an obvious choice is the vector autoregression (VAR) framework, due to Sims (1972, 1980). The technique assumes no traditional functional form, but rather assumes that each endogenous variable can be expressed as a linear function of its own lagged values as well as lagged values of all other endogenous variables in the system. The primitive form of the VAR is

$$\beta_0 \hat{\kappa}_{f,i,t} = \beta_t + \sum_{s=1}^{q} \beta_s \hat{\kappa}_{f,i,t-s} + u_{i,t}, \tag{6}$$

where $\hat{\kappa}_{f,i,t} \equiv \begin{bmatrix} \hat{k}^p_{f,i,t} \\ \hat{k}^a_{f,i,t} \end{bmatrix}$, $\hat{k}^p_{f,i,t}$ and $\hat{k}^a_{f,i,t}$ are (respectively) the changes per unit time in the stocks of privately-held foreign capital and of publicly-held foreign capital in country *i* in period *t*, $\beta_t \equiv \begin{bmatrix} \beta_{p,t} \\ \beta_{a,t} \end{bmatrix}$ is a matrix of constants, $\beta_s \equiv \begin{bmatrix} \beta^s_{pp} & \beta^s_{ap} \\ \beta^s_{pa} & \beta^s_{aa} \end{bmatrix}$ are the regression coefficients such that $\beta^0{}_{pp} = \beta^0{}_{aa} = 1$, $u_{i,t} \equiv \begin{bmatrix} u^p_{i,t} \\ u^a_{i,t} \end{bmatrix}$ is the matrix of error terms, and *q* is the number of lags to be included. We assume $E[u_{i,t}] = 0$, $E[u_{i,t}\, u_{i,t}'] = I$, and $E[u_{i,t}\, u_{i,s}'] = 0 \;\forall\; s \neq t$. Letting $\varphi_t = \beta_0^{-1}\beta_t$, $\varphi_s = \beta_0^{-1}\beta_s$, and $\varepsilon_{i,t} = \beta_0^{-1}u_{i,t}$, we have the standard form

$$\hat{\kappa}_{f,i,t} = \varphi_t + \sum_{s=1}^{q} \varphi_s \hat{\kappa}_{f,i,t-s} + \varepsilon_{i,t}, \tag{7}$$

where $E[\varepsilon_{i,t}] = 0$, $E[\varepsilon_{i,t}\varepsilon_{i,t}'] \equiv \Omega = \begin{bmatrix} \sigma_{pp} & \sigma_{ap} \\ \sigma_{pa} & \sigma_{aa} \end{bmatrix}$, $\sigma_{pp} = \text{var}(\varepsilon_{i,t}^{p})$, $\sigma_{aa} = \text{var}(\varepsilon_{i,t}^{a})$, and $\sigma_{ap} = \sigma_{pa} = \text{cov}(\varepsilon_{i,t}^{a}, \varepsilon_{i,t}^{p})$. Estimation of (7) by ordinary least squares requires the assumption that $E[\varepsilon_{i,t}\hat{\kappa}_{f,i,t-s}] = 0 \; \forall \; s$. This may be violated if unobserved country characteristics attract foreign capital to the country, resulting in omitted variable bias. A tempting way to eliminate this problem is to include a fixed effect z_i, which is 1 for country i and 0 otherwise. This gives

$$\hat{\kappa}_{f,i,t} = \varphi_t + \sum_{s=1}^{q} \varphi_s \hat{\kappa}_{f,i,t-s} + z_i + \varepsilon_{i,t}, \tag{8}$$

and we can estimate the first-differenced version of (8) to eliminate the omitted variable bias,

$$\left(\hat{\kappa}_{f,i,t} - \hat{\kappa}_{f,i,t-1}\right) = \left(\varphi_t - \varphi_{t-1}\right) + \sum_{s=1}^{q} \varphi_s \left(\hat{\kappa}_{f,i,t-s} - \hat{\kappa}_{f,i,t-s-1}\right) + \left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right). \tag{9}$$

But in solving one problem we have introduced another, as Nerlove (1967) and Nickell (1981) point out. Estimating (9) by ordinary least squares will also give biased coefficients, since $E\left[\varepsilon_{i,t-1}\hat{\kappa}_{f,i,t-1}\right] \neq 0$ implies $E\left[\left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\left(\hat{\kappa}_{f,i,t-1} - \hat{\kappa}_{f,i,t-2}\right)\right] \neq 0$. Monte Carlo evidence has suggested that this bias could be large in panels of the dimensions of the one at hand (Judson and Owen 1999). Anderson and Hsiao (1982) and Holtz-Eakin, Newey, and Rosen (1988) suggest eliminating the bias by instrumenting for the once-lagged dependent variable on the right-hand side of (9) with predetermined values of the dependent variable. This requires the moment conditions $E[\varepsilon_{i,t}\hat{\kappa}_{f,i,t-s}] = E[\varepsilon_{i,t} z_i] = 0 \; \forall \; s > 0$, which imply that

$$E\left[\left(\varepsilon_{i,t} - \varepsilon_{i,t-1}\right)\left(\hat{\kappa}_{f,i,t-s} - \hat{\kappa}_{f,i,t-s-1}\right)\right] = 0 \; \forall \; s > 1. \tag{10}$$

Thus a vector of instruments permitting the identification of (9) is

$$Z_{i,t} = \left[1, \left(\hat{\kappa}_{f,i,t-2} - \hat{\kappa}_{f,i,t-s-3}\right), \ldots, \left(\hat{\kappa}_{f,i,1} - \hat{\kappa}_{f,i,0}\right)\right]. \tag{11}$$

Arellano and Bond (1991) present the estimator of this type used herein. They present a test of the validity of (10), as well as discuss the unbiasedness of their estimator faced with an unbalanced panel provided that deletions from the panel have been random.

There remains the choice of the number of lags q to include, for which there is in this case no theoretical limitation. In this analysis the choice is made by sequential F-tests of H_0: $\varphi_s = 0$. Immediately thereafter, Granger (1969) causality tests on the $\{\varphi_s\}$ can be performed. As Hurlin and Venet (2001) point out, Granger causality could be heterogeneous across countries. Herein we will only be interested, however, in capital flows to developing countries as a group.

VI
Impulse-Response Functions

Estimated VAR coefficients provide the raw material for predicting how the two different types of capital interact over time. We can use those coefficients to build estimates of the response of current private capital flows to a change in past World Bank flows—or vice versa—as well as using them to measure flow persistence (current response to past changes in their own levels). Predicting the response of $\hat{\kappa}_{f,i,t}$ to an impulse in any element of the $\left\{\hat{\kappa}_{f,i,t-s}\,\forall s > 0\right\}$ requires, however, further calculation. We can rewrite (7) as

$$\hat{\kappa}_{f,i,t} = \left(I - \sum_{s=1}^{q} \varphi_s \mathrm{L}^s\right)^{-1} \left(\varphi_t + \varepsilon_{i,t}\right), \tag{12}$$

where L is the lag operator. Assuming the stability condition that all roots of $\left|I - \sum_{s=1}^{q} \varphi_s \mathrm{L}^s\right|$ = 0 lie outside the unit circle, (12) has a moving average representation

$$\hat{\kappa}_{f,i,t} = \overline{\varphi}_t + \sum_{s=0}^{\infty} A_s \varepsilon_{i,t-s}\,, \tag{13}$$

where $A_s = \sum_{j=1}^{q} \varphi_j A_{s-j}$, $A_0 = I$, and $A_s = 0\ \forall\ s < 0$. The predictions of Table 1 regarding long-term responses of capital flows to past shocks can be thought of as testable overidentifying restrictions on linear combinations of elements of the $\{A_s\}$.

Equation (13) requires scrutiny, however, before it can be used to predict the response of current capital flows to past shocks. We have at no time assumed that $\sigma_{ap} = 0$. Thus a shock to $\varepsilon^{a}_{i,t-1}$ can affect current capital flows not only through the relationship described in (13) but also through its contemporaneous correlation with $\varepsilon^{p}_{i,t-1}$, which will have a separate impact on current flows through (13). Such correlation would bias the impulse-response estimates. We require either a theoretical or empirical reason to believe that there is no such correlation, or we must correct for it.

One way to capture this contemporaneous effect would be to recover the $\{\beta_s\}$ and carry out the analysis using the orthogonal errors of the primitive model, but (6) is not identified by the parameters estimated in (9). The latter gives $4q + 5$ parameter estimates (four for each φ_s, two for the constant term, two error variances and one error covariance), and the former requires $4q + 6$ parameters (four for each β_s, two for β_0, two for the constant term, and two variances of the orthogonal errors). One additional identifying restriction would be needed.

The method suggested by Sims (1980), and followed in much of the applied VAR literature, is to use a theoretically motivated restriction that either $\beta_{ap}^{0} = 0$ or $\beta_{pa}^{0} = 0$.[7] Such an assumption would be untenable in the present case since we have no theoretical reason to rule out contemporaneous response of public to private capital flows, nor vice versa. It is conceivable that private capital flows could react immediately to World Bank action, just as the World Bank might interrupt loan disbursements in the midst of a financial crisis. Even if there were grounds for this restriction, the resulting impulse-response predictions would have a well-known and undesirable sensitivity to the ordering of the variables in the VAR.

[7] Alternatively, Swanson and Granger (1997) suggest imposing a Sims restriction based on using empirically observed patterns in the errors to infer causal ordering.

Blanchard and Quah (1989) suggest an alternative approach involving theory-based restrictions on the long-run effects of one type of capital flow on the other. They let the moving average representation of the orthogonal shocks in (6) be

$$\hat{\kappa}_{f,i,t} = \bar{\beta}_t + \sum_{s=0}^{\infty} B_s u_{i,t-s} \ , \tag{14}$$

but B_0 requires four identifying restrictions. Two come from $\beta^0_{pp} = \beta^0_{aa} = 1$. Noting that $\varepsilon_{i,t} = \beta_0^{-1} u_{i,t}$, an additional restriction comes from $\Omega = \mathrm{E}[\varepsilon_t \varepsilon_t'] = \beta_0^{-1} \beta_0^{-1\prime}$. The fourth restriction comes from assuming that one element of $\sum_{s=0}^{\infty} B_s = \sum_{s=0}^{\infty} A_s \beta_0^{-1} = \left(\sum_{s=0}^{\infty} A_s \right) \beta_0^{-1}$ is zero. With these in place, (6) and (14) can yield exact unbiased predictions of the response by current flows to present and lagged shocks. The fourth restriction is equivalent to assuming that a shock to one type of capital flow has no long-run effect on the other flow. Again, there is no *a priori* justification for such an assumption in this case. A World Bank investment could crowd in private capital on the long term, just as private investment could crowd out World Bank capital on the long term.

A third alternative identifying restriction would be to assume $\beta_{ap}^0 = \beta_{pa}^0$, a technique due to Koop, Pesaran, and Potter (1996) and Pesaran and Shin (1998). Rather than attempting to calculate impulse-response functions with no contemporaneous correlation between errors, this "generalized impulse-response function" technique simply uses sample estimates of that correlation—implicitly assuming that the effects of contemporaneous shocks are symmetric. That is, the expected contemporaneous shock to the entire $\varepsilon_{i,t}$ vector due to a unit impulse to one of its elements is taken to be

$$E[\varepsilon_{i,t} \mid \varepsilon_{i,t}^j = 1] = \begin{bmatrix} \sigma_{pj} \\ \sigma_{aj} \end{bmatrix} \sigma_{jj}^{-1} \text{, where } j \in \{a,p\}. \tag{15}$$

Equations (13) and (15) allow unbiased prediction of the response in current capital flows to a unit impulse in either type of flow, arbitrarily far back in time.

Again, the need for any such restriction hinges on the existence of significant contemporaneous impact on each type of capital flow due to shocks to the other. Such

effects would show up after estimation of (9) as deviations from zero in the off-diagonal elements of $E[(\varepsilon_{i,t} - \varepsilon_{i,t-1})'(\varepsilon_{i,t} - \varepsilon_{i,t-1})]$.

VII
Results

Our goal is to search for evidence of the conditions outlined in Table 1. We will initially consider only the interaction between privately-owned and publicly-owned foreign capital flows to developing countries, later expanding the analysis to embrace domestically-owned capital.

All data on capital flows, both public and private, come from the World Bank.[8] Only developing country members of the World Bank Group for which the Group reports credit data are included in the sample, and all 137 such countries are included.[9] We will begin by taking net disbursements by the International Bank for Reconstruction and Development[10] to represent publicly-owned foreign capital, and net private capital inflows of all types to represent privately-owned foreign capital. Later we will explore the sensitivity of the results to using other types of lending as "public" and "private" foreign capital.

Tables 2 and 3 show estimations of equation (9) at different lag lengths. Table 2 gives the upper equation of the VAR, with net private foreign investment as a percentage of GDP (*PRIV*) on the left hand side, and Table 3 has net disbursements from the International Bank for Reconstruction and Development as a percentage of GDP (*PUBL*) on the left hand side. The panel is nine periods long with each period representing total flows over the course of three years, such that the panel covers the years between 1971 and 1998.

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[8] See the appendix for definitions of the types of capital flows as well as data sources. IBRD flows represent the large majority of total World Bank disbursements, a majority that has increased greatly over the last two decades.

[9] The appendix lists these countries.

[10] The IBRD is the non-concessional public lending arm of the World Bank Group. Other members include the International Development Association (IDA), which makes public loans on concessional

We first seek a specification for which Arellano and Bond's estimator is not biased by second-order autocorrelation. Their F-test of the restriction in equation (10), whose result is given in the tables, suggests that it is inappropriate to include just one lag (Table 2) or include three or four lags (Table 3). We also seek a specification for which it is possible to reject the hypothesis that the last included lags of both regressors enter the equation with a coefficient of zero, suggesting against including three, four, or five lags (Table 2) as well as two or four lags (Table 3). On this evidence alone, a specification of either two, three, or four lags might be appropriate. In Table 4, the Akaike (1973, 1974) Information Criterion and the Schwarz (1978) Bayesian Information Criterion both counsel towards parsimony. These tests point toward a specification with two or three lags, and possibly four, being most appropriate. Any conclusions we draw must be robust to this choice.

Table 4 summarily rejects the hypothesis that Ω is not diagonal regardless of specification, implying that a Sims restriction (β_0 triangular) or even the stronger $\beta_{ap}^{\,0} = \beta_{pa}^{\,0} = 0$ would not bias the coefficient estimates. To err on the conservative side, for the purposes of this analysis we retain the less restrictive Koop et al. identifying assumption that simply $\beta_{ap}^{\,0} = \beta_{pa}^{\,0}$. Figure 2 reports the results of using the correction (15) to estimate the impulse-response functions in (13) for various specifications, along with the biased OLS and panel fixed effects estimators for comparison.[11]

Figure 2 displays several striking features. Most notable at the lower left is the strong negative association between lagged IBRD capital flows and subsequent private flows for 15 years, regardless of specification. The small later positive association under some specifications does not come close to compensating for the large initial dip. Recall from Table 2 that IBRD flows Granger cause private flows, so this effect is statistically

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terms.

[11] Note that the predictions of the OLS and panel fixed effects estimators often differ greatly, clear evidence of the need for equation (8) even without performing Holtz-Eakin (1988) tests for individual effects.

significant.[12] Also notable in the upper right portion of the figure is the absence of a strong relationship between lagged private flows and current IBRD flows. The relationship is positive and statistically significant (in Table 3, *PRIV* Granger causes *PUBL*) but is very small. Both public and private flows demonstrate persistence, predictably more so in public flows than private. All exhibit dynamic stability.

Figure 3 shows the corresponding cumulative impulse responses, obtained simply by summing the response coefficients of Figure 2 across time. The result could be interpreted as a predicted change in the *stock* of response capital due to a shock in the *flow* of impulse capital. At the lower left, an increase in IBRD flows by 1% of GDP is associated with a lasting *decrease* in the stock of foreign private capital by 1.5% to 2.5% of GDP depending on lag length. At the upper right, an impulse to lagged private flows is associated with an increase in total IBRD capital stock that may or may not be slightly greater than zero. At the lower right, a positive shock to IBRD flows encourages the long-term accumulation of IBRD capital, perhaps to a slightly greater degree than the cumulative own-impulse response seen in private capital at the upper left.

Statistical inference on these cumulative results is complicated by the fact that, through equation (13), even a single cumulative impulse-response coefficient can be an extremely complex nonlinear combination of the VAR coefficients φ_s with thousands of terms. Testing an exact linear restriction on a sum of the cumulative coefficients from periods 0 through 15 would exceed available computing resources. A feasible alternative is Efron's (1979) bootstrap.

This analysis employs a two-stage bootstrapping technique. In the first stage, 1000 simulated datasets are created by randomly adding residuals sampled with

[12] Here and elsewhere in this study, it must be kept in mind that Granger causality is not true causality. Human foresight breaks the link between the two, raising the possibility that *post hoc* actions were not caused by some antecedent event but rather that the antecedent took place upon correct prediction of the later actions (reverse causality, also known as the *post hoc ergo propter hoc* fallacy). To give credence to such a scenario here would require the conclusion that World Bank flows did not cause private flows to decline but rather that World Bank flows increased due to the systematically correct prediction of declines in private lending—an average of nine years in advance—an extreme and implausible inference.

replacement from the true residuals to capital flows predicted by the coefficients of a three-lag Arellano and Bond estimator.[13] Repeating the analysis on each simulated dataset produces a distribution and 90% confidence interval for each of the impulse-response coefficients shown in Figure 2. It would be inappropriate, however, to estimate a 90% confidence interval for the *cumulative* impulse responses by summing, say, the 5th percentile single-period impulse-responses along each tail of each distribution of the individual impulse responses. Assuming sixteen successive unlikely outcomes in this fashion would yield an excessively broad $1 - (0.1)^{16} \approx 100\%$ confidence interval on their sum. A second-stage bootstrap solves this problem. This stage involves creating 1000 sets of *cumulative* impulse response coefficients by summing (in each case) random draws with replacement from the distributions of each of the 16 individual impulse response coefficients.

Figure 4 presents the resulting simulated cumulative functions for the response of public flows to an impulse in private flows and vice versa, overlaid. The two curves correspond to the upper right and lower left panels of Figure 3. In each case, the bold solid line shows the average of the 1000 cumulative impulse responses, and the lighter lines on each side represent 80% and 90% confidence intervals. Based on these results, we reject at the 5% level a one-tailed test of the null hypothesis that the cumulative response of IBRD capital to an impulse in private capital is less than zero. We can likewise reject at 5% a one-tailed test of the null hypothesis that the cumulative response of private flows to an impulse in IBRD lending is greater than zero.

At last we can address the overidentifying restrictions in Table 1. In the left half of the table, we reject that the World Bank substitutes one-for-one (in fact, we reject that it substitutes at all) for the departure of private foreign capital. Replacing a decline in private capital with a surge in IBRD lending would require a cumulative impulse-response coefficient on the upper curve of Figure 4 that achieved some value between

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[13] It is not statistically meaningful to bootstrap across countries in this case, as in other panel bootstrap situations, since the dataset includes *all* developing countries receiving World Bank capital and does not represent a random sample of a larger population.

zero and –1. In fact, it is statistically significantly positive. In the right half of the table, we reject that past World Bank lending is positively associated with subsequent private capital flows. This condition would require the lower curve in Figure 4 to rise above the zero line at some point; it does not.

Said differently, Figure 4 shows that inflows of IBRD capital neither complement nor substitute for private capital inflows. If past increases in IBRD lending were associated with subsequent increases in private flows, the lower line would lie above the x-axis. If past declines in private lending were associated with subsequent rises in IBRD lending, the upper line would lie below the x-axis.[14]

IBRD lending is the focus of this work but is certainly not the only form of international public finance for development. Does concessional credit from the International Development Association (IDA) substitute for private capital? Is bilateral aid more effective at crowding in private foreign investment than IBRD loans? Figure 5 explores the sensitivity of the results to using different types of capital flows as proxies for publicly-owned or privately-owned foreign capital. In the impulse response functions labeled *IDA*, net disbursements from IDA have been used for *PUBL*. For *BILATERAL*, direct government-to-government aid flows have been used for *PUBL*. In the *IMF* curves, change in the stock of obligations to the International Monetary Fund represent *PUBL*. For curves labeled *PPG*, public and publicly-guaranteed debt from private creditors represents *PRIV* while IBRD lending once again represents *PUBL*. That is, *PPG* simply removes from the earlier figures for *PRIV* that portion received by private borrowers.

It is noteworthy that IBRD credit is the type of international public capital most

[14] An alternative explanation for the same result would be that World Bank capital replaces private capital completely, but only for a limited set of countries whose access to private capital has not changed over time at all—that is, in countries for which there has been no impulse to private capital whose effects on public inflows we could observe. Since many countries in the sample have seen their access to private capital vary significantly over the last 30 years, this explanation is not plausible.

negatively associated with subsequent private capital flows. IDA credits do not substitute for declines in private lending and are not significantly associated with subsequent increases in private flows (the small positive effect seen in the figure is not significant, since *PUBL* does not Granger cause *PRIV* in that case).[15] Both bilateral flows and IMF lending are negatively and significantly associated with later private capital inflows (*PUBL* Granger causes *PRIV* in both cases). Private foreign credit to developing country governments is not as negatively associated with IBRD lending as total private foreign lending. This might suggest that IBRD lending is less ineffective at helping governments to become creditworthy than it is at helping developing countries' private sectors to become creditworthy. At the lower right, we see as expected that IMF lending is the least persistent form of international public finance while bilateral flows are the most persistent.

In all of the preceding analysis we have focused solely on international capital flows, ignoring accompanying changes in the stock of domestically-owned capital. Equation (3) predicts that k_d could be endogenously determined along with foreign-owned capital, so it is useful to investigate the sensitivity of the results to inclusion of k_d. For example, if the social planner were to successfully raise the marginal productivity of capital m, domestic investors might be expected to respond along with their foreign counterparts. If the social planner is merely substituting for foreign capital cut off by a cross-border borrowing constraint, the incentives of domestic investors would remain unaffected.

Table 5 reports the results of expanding the VAR in (9) to include changes in the stock of domestically-owned capital k_d, referred to as domestic investment financed domestically (DIFD).[16] The identifying assumption of Koop et al. is retained. In all

[15] The model used here makes no clear prediction about the effect of concessional lending on private capital inflows. To the degree that k_f is limited by international capital market failure, interest free lending should crowd out private lending one-for-one. To the degree that it is limited by fundamental capital productivity or domestic market failures, the only rationale for IDA lending is to change ϕ, which could increase m and thereby encourage private lending, but adding to the total capital stock has a countervailing influence on m.

[16] DIFD is calculated as Gross Domestic Investment less net foreign capital inflows of all types.

three equations, F-tests fail to reject the null hypothesis that the coefficient on the last included lag of all three regressor types are jointly equal to zero. For the two-lag specifications, Arellano and Bond's test for no second-order autocorrelation fails to reject in all cases. For these reasons we adopt the two-lag specification below.

In the impulse-response functions of Figure 6, responses of all three types of flows to impulses in *PRIV* are consistent with the predictions of "no international capital market failure" in Table 1 but inconsistent with the alternative. At the bottom, responses to impulses in *DIFD* are perhaps more consistent with the "no failure" case as well. Both of these suggest that World Bank flows are substituting neither for missing private foreign capital nor for missing private domestic capital. If IBRD capital were substituting, we would expect a negative response of IBRD flows to a positive impulse in private flows or DIFD; both responses are positive. At the upper right, neither domestic nor foreign flows of private capital respond positively to past impulses in IBRD credit. This suggests that IBRD lending has been unsuccessful at catalyzing private investment of any kind, regardless of whether the source is foreign or domestic. Figure 7 reports the long-term cumulative impulse responses. They reveal for example that an increase of 1% of GDP in IBRD lending is associated with a subsequent 4% of GDP (or greater) drop in DIFD—the propensity of developing country investors to invest their wealth at home.

VIII
Discussion

In light of Table 1, the results of Figure 4 suggest that the World Bank has neither stepped in to substitute for private international lending nor has it successfully catalyzed such lending. If the avoidance of developing countries by private international investors is governed by international market failure, the World Bank has not acted as the optimal international public financier because it has not replaced private capital. Likewise, if investment patterns reflect differences in the fundamental productivity of capital or in the degree of domestic market failure, Bank lending has not significantly ameliorated those failings because its loans have not encouraged subsequent private lending.

It is important to stress the implications of these results for the direction of causation. Omitted variables are not responsible for the association between IBRD loans and lower subsequent private loans. If this relationship were not due to some force associated with the IBRD loans themselves but rather to some unobserved third force that simultaneously drove up Bank lending and drove down private lending, we would see the same negative correlation between current Bank lending and lagged private lending. But this latter correlation is positive. This suggests that it is indeed the Bank loans themselves, or some associated force that necessarily follows in their wake, which discourages private lending.

In a policy sense, the question of what the Bank *should* have been doing becomes moot. Regardless of why private investors in rich countries shun poor countries—because of international capital market failures or because of low domestic productivity—the Bank has not responded optimally. As an international public financier it has lived up to the hopes of neither school of thought traced in Section 2 through the decades since its founding through today.

But this is a positive—not a normative—result. How or whether to change the extant system of international public finance is an issue this paper does not address at all. An additional, and separate, policy debate revolves around whether to "mend" or "end" aid—that is, whether the suboptimality of past aid flows counsel the downsizing of aid agencies or simply their redirection (e.g., McPherson and Gray 2000). The results presented here imply nothing whatsoever about the answer to this important question.

Why and by what mechanism does IBRD lending actually discourage subsequent private capital flows? The ground is well prepared for research. Studies of the ability of public investment in general to 'crowd in' private investment in developing countries have come to a wide range of sharply contradictory conclusions. Servén and Solimano (1993) review several empirical studies on this relationship, some of which find a positive correlation, and some the opposite. More recently, Everhart and Sumlinski

(2001) review twenty empirical studies carried out from 1984 to 2001; roughly half find that public investment encourages private investment in LDCs, and half find the opposite. They conclude that while "[a] vast literature covers this subject … not only is there no consensus on the topic, but there are contradictory results, even for the same regions and countries." Everhart and Sumlinski's own empirical work suggests a more negative relationship in more corrupt countries, but the mechanism is not clear.

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Figure 1: Cumulative private foreign investment inflows as a percent of GDP, 1985-1999.

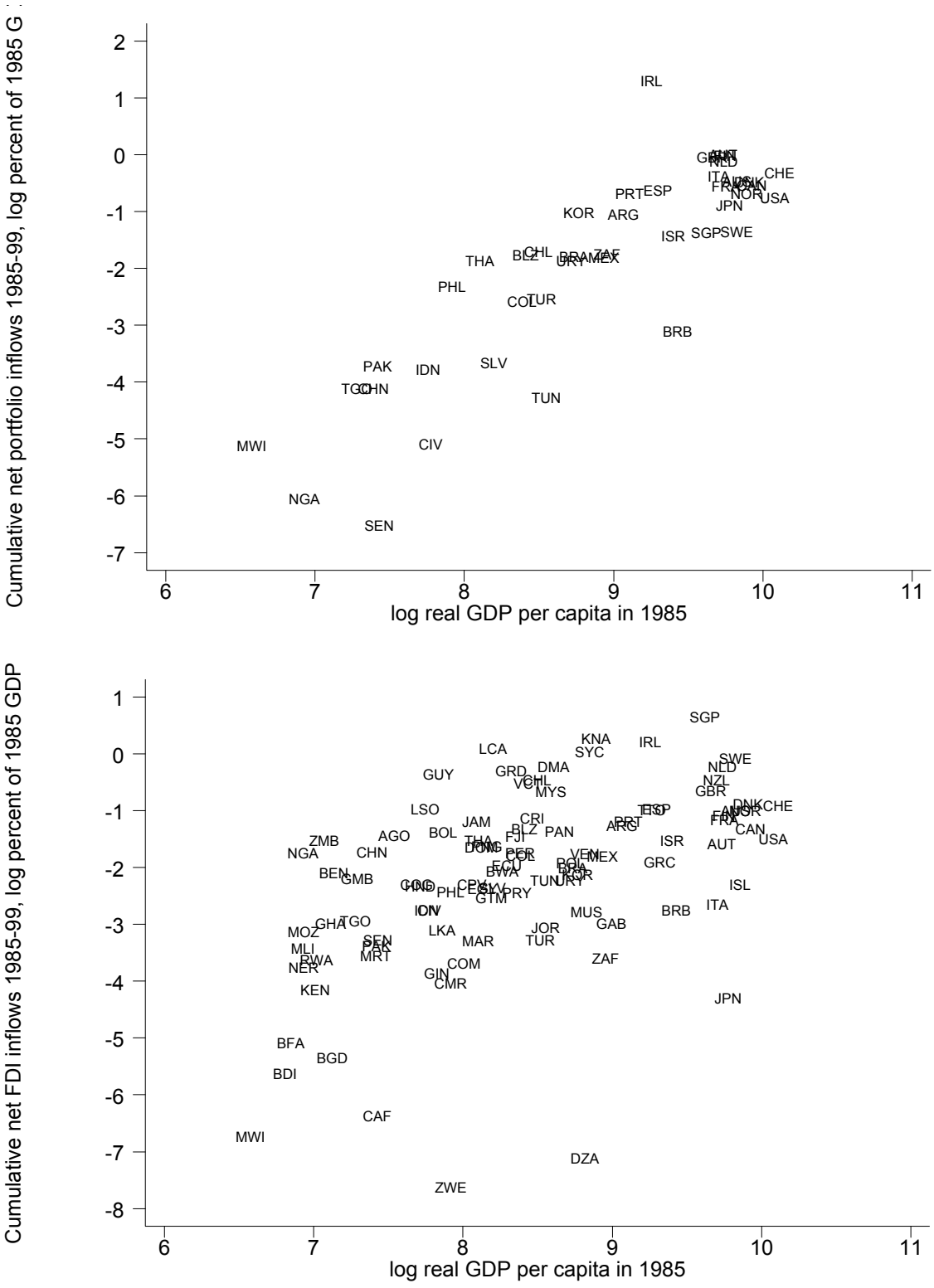


Table 1. Summary of testable predictions

	International market failure			No international market failure		
	lagged k_f^p/y	lagged k_f^a/y	lagged k_d/y	lagged k_f^p/y	lagged k_f^a/y	lagged k_d/y
current k_f^p/y	≥ 0	0	0	≥ 0	> 0	> 0
current k_f^a/y	-1	≥ 0	0	0	≥ 0	0
current k_d/y	0	0	≥ 0	> 0	> 0	≥ 0

Shading indicates those cells in which predictions differ between the cases with and without international capital market failure.

Table 2. Lag length selection, dependent variable $PRIV_t$, Arellano and Bond estimator

$PRIV_{t-1}$	0.438	0.401	0.295	0.209	0.252
	(9.80)	(8.35)	(5.43)	(3.73)	(3.47)
$PRIV_{t-2}$		–0.0944	–0.111	–0.133	–0.0710
		(–2.30)	(–2.63)	(–2.96)	(–1.43)
$PRIV_{t-3}$			0.0161	0.0342	0.0665
			(0.38)	(0.84)	(1.38)
$PRIV_{t-4}$				–0.00611	–0.0605
				(–0.16)	(–1.49)
$PRIV_{t-5}$					0.0390
					(0.98)
$PUBL_{t-1}$	–0.455	–0.530	–0.277	–0.214	0.0178
	(–1.63)	(–1.83)	(–0.94)	(–0.78)	(0.07)
$PUBL_{t-2}$		–0.140	–0.519	–0.721	–0.525
		(–0.48)	(–1.89)	(–2.72)	(–1.95)
$PUBL_{t-3}$			–0.608	–0.0823	–0.0132
			(–1.79)	(–0.26)	(–0.04)
$PUBL_{t-4}$				–0.224	–0.234
				(–0.67)	(–0.67)
$PUBL_{t-5}$					–0.198
					(–0.50)
Constant	0.00108	–0.0000558	–0.000785	0.000130	0.00351
	(2.33)	(–0.10)	(–1.25)	(0.18)	(3.64)
N	772	648	537	431	333
Groups	123	111	106	98	89
Mean obs/group	6.28	5.84	5.07	4.40	3.74
F-test of H_0: *PUBL* does not Granger cause *PRIV*					
F statistic	2.67	3.94	9.80	10.7	4.34
p value	0.103	0.140	0.0203	0.0306	0.501
Arellano and Bond test of H_0: No 2nd-order autocorrelation					
F statistic	–1.96	–0.360	–0.100	–0.350	–0.980
p value	0.0498	0.719	0.922	0.725	0.329
F-test of H_0: Coefficients on final included lags of both *PRIV* and *PUBL* are jointly equal to zero					
F statistic	97.6	5.46	3.38	0.480	1.19
p value	0.000	0.0652	0.184	0.787	0.552

PRIV is net private capital inflows as a percentage of GDP. *PUBL* is IBRD disbursements minus principal repayments as a percentage of GDP. Length of panel is T = 9, covering 1971-1998, where each time period represents cumulative capital flows during three years. *t*-statistics are reported in parentheses below each coefficient estimate.

Table 3. Lag length selection, dependent variable $PUBL_t$, Arellano and Bond estimator

$PRIV_{t-1}$	0.0237	0.0192	0.0272	0.0260	0.0137
	(3.73)	(2.91)	(3.24)	(2.48)	(1.15)
$PRIV_{t-2}$		0.00287	–0.000869	0.00150	0.00422
		(0.41)	(–0.11)	(0.15)	(0.37)
$PRIV_{t-3}$			0.0122	0.0140	0.00954
			(1.51)	(1.54)	(0.91)
$PRIV_{t-4}$				–0.0169	–0.0111
				(–1.81)	(–1.19)
$PRIV_{t-5}$					–0.00775
					(–0.80)
$PUBL_{t-1}$	0.494	0.490	0.521	0.505	0.414
	(12.76)	(12.00)	(10.35)	(8.58)	(7.09)
$PUBL_{t-2}$		–0.0367	–0.0646	–0.0803	–0.0454
		(–0.91)	(–1.39)	(–1.43)	(–0.80)
$PUBL_{t-3}$			–0.0957	–0.0915	–0.258
			(–1.74)	(–1.47)	(–3.51)
$PUBL_{t-4}$				–0.0512	–0.00381
				(–0.78)	(–0.06)
$PUBL_{t-5}$					–0.183
					(–2.57)
Constant	–0.000454	–0.000519	–0.000568	–0.000632	–0.000438
	(–5.90)	(–5.86)	(–4.82)	(–3.84)	(–2.12)
N	772	648	537	431	333
Groups	123	111	106	98	89
Mean obs per group	6.28	5.84	5.07	4.40	3.74
F-test of H_0: *PRIV* does not Granger cause *PUBL*					
F stat	13.9	9.09	10.82	12.2	5.51
p value	0.0002	0.0106	0.0128	0.0159	0.356
Arellano and Bond test of H_0: No 2nd-order autocorrelation					
F stat	–0.56	0.630	2.38	3.36	0.46
p value	0.573	0.530	0.0175	0.000800	0.642
F-test of H_0: Coefficients on final included lags of both PRIV and PUBL are jointly equal to zero					
F stat	82.0	1.02	5.33	3.97	7.35
p value	0.000	0.600	0.0697	0.137	0.0254

PRIV is net private capital inflows as a percentage of GDP. *PUBL* is IBRD disbursements minus principal repayments as a percentage of GDP. Length of panel is T = 9, covering 1971-1998, where each time period represents cumulative capital flows during three years. *t*-statistics are reported in parentheses below each coefficient estimate.

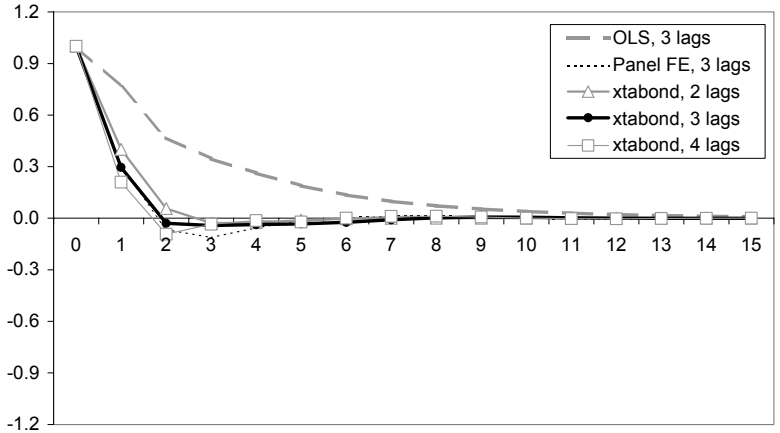
Table 4. Additional criteria for lag-length selection and contemporaneous correlation of shocks

Number of lags	1	2	3	4	5
Correlation(e^{p}_{it}, e^{a}_{it})	0.00980	–0.00160	–0.0173	–0.0120	0.0168
t-test of H_0: $E[e^{p}_{it} \cdot e^{a}_{it}] = 0$					
t statistic	0.29	–0.01	–0.39	–0.25	0.31
p value	0.768	0.990	0.695	0.804	0.760
AIC	–13,027	–11,013	–9,157	–7,442	–5,846
SBC	–12,985	–10,973	–9,118	–7,405	–5,812

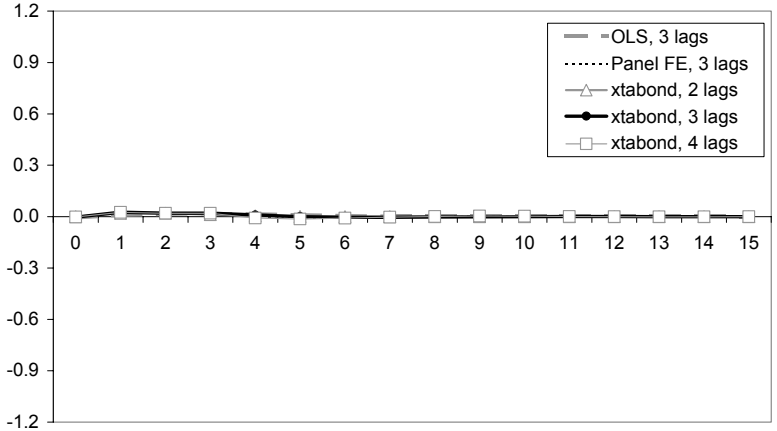
AIC stands for the Akaike Information Criterion, and SBC stands for the Schwarz-Bayesian Information Criterion. Here, $e_{i,t}$ represents the sample estimate of the true residual $\varepsilon_{i,t}$.

Figure 2. Impulse response functions derived from various specifications

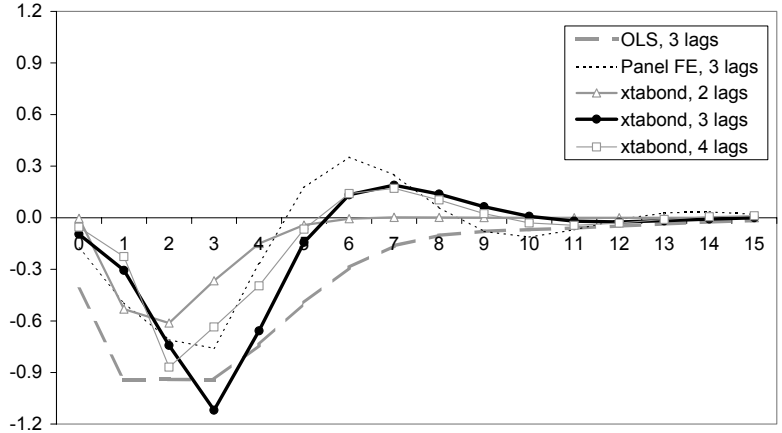
Specification sensitivity: Unit impulse to private flows, response of private flows



Specification sensitivity: Unit impulse to private flows, response of World Bank flows



Specification sensitivity: Unit impulse to World Bank flows, response of private flows



Specification sensitivity: Unit impulse to World Bank flows, response of World Bank flows

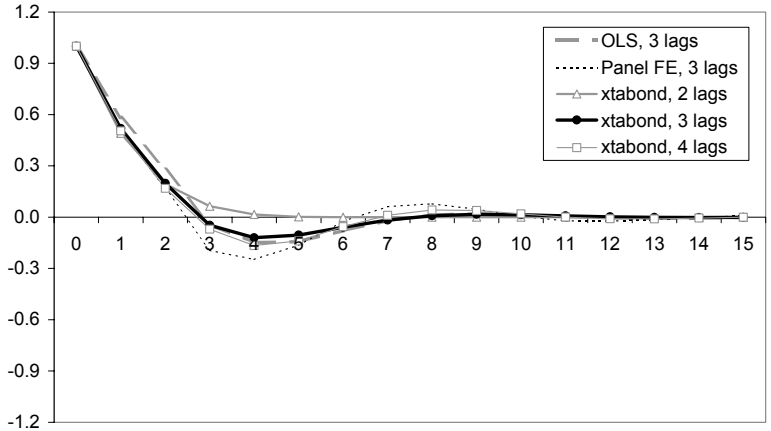


Figure 3. Cumulative impulse response functions derived from various specifications

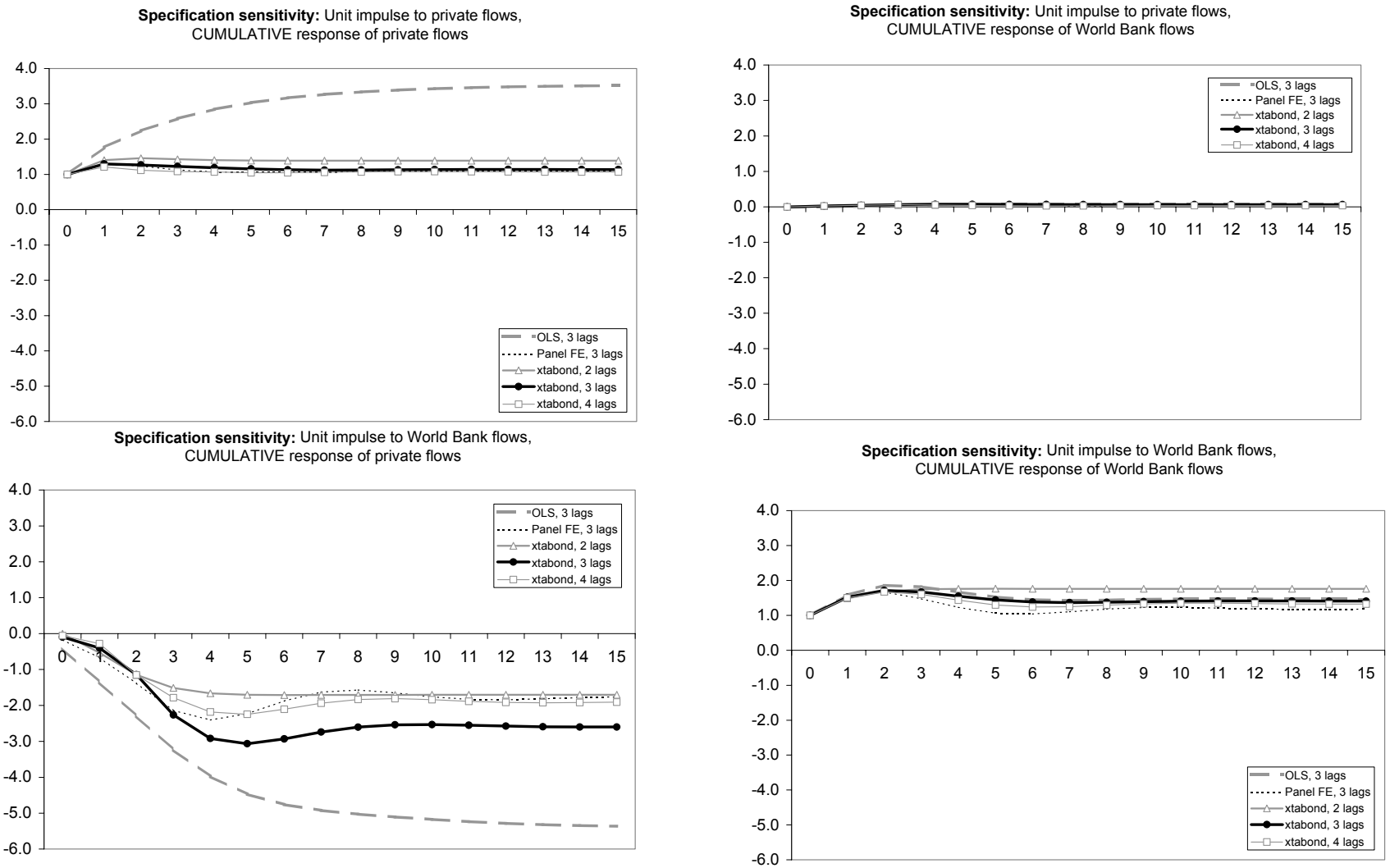


Figure 4. Results of the two-stage bootstrap exercise

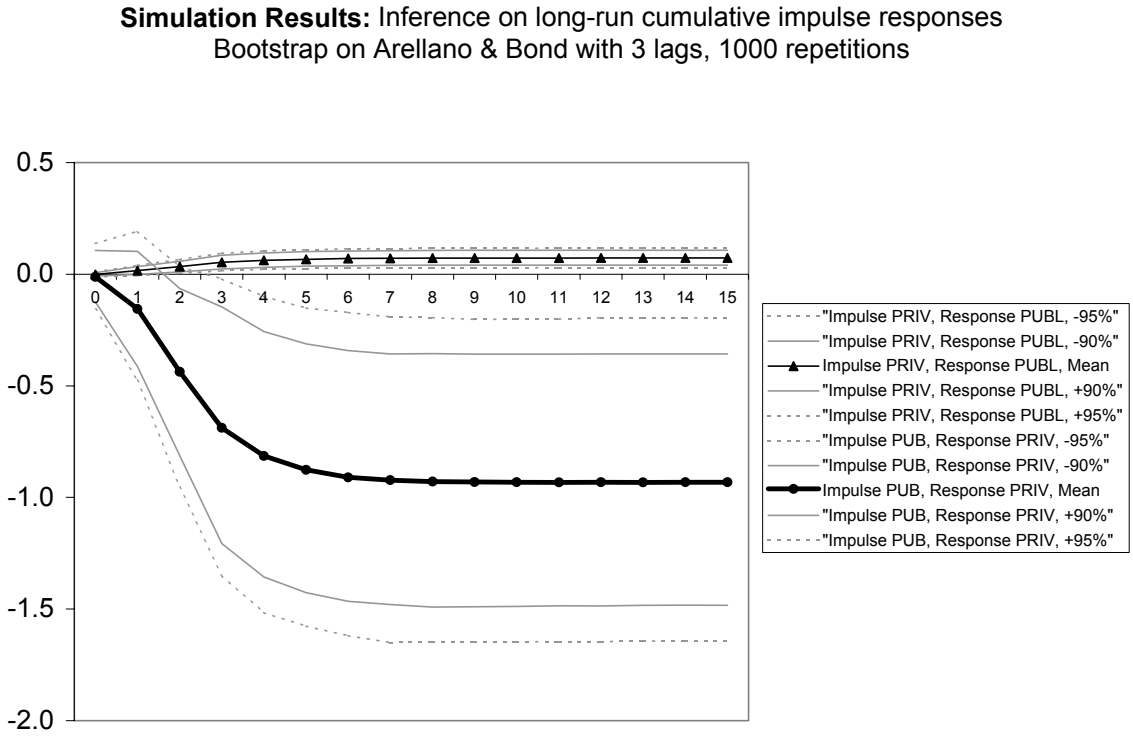


Figure 5. Repeating the analysis for other types of international capital

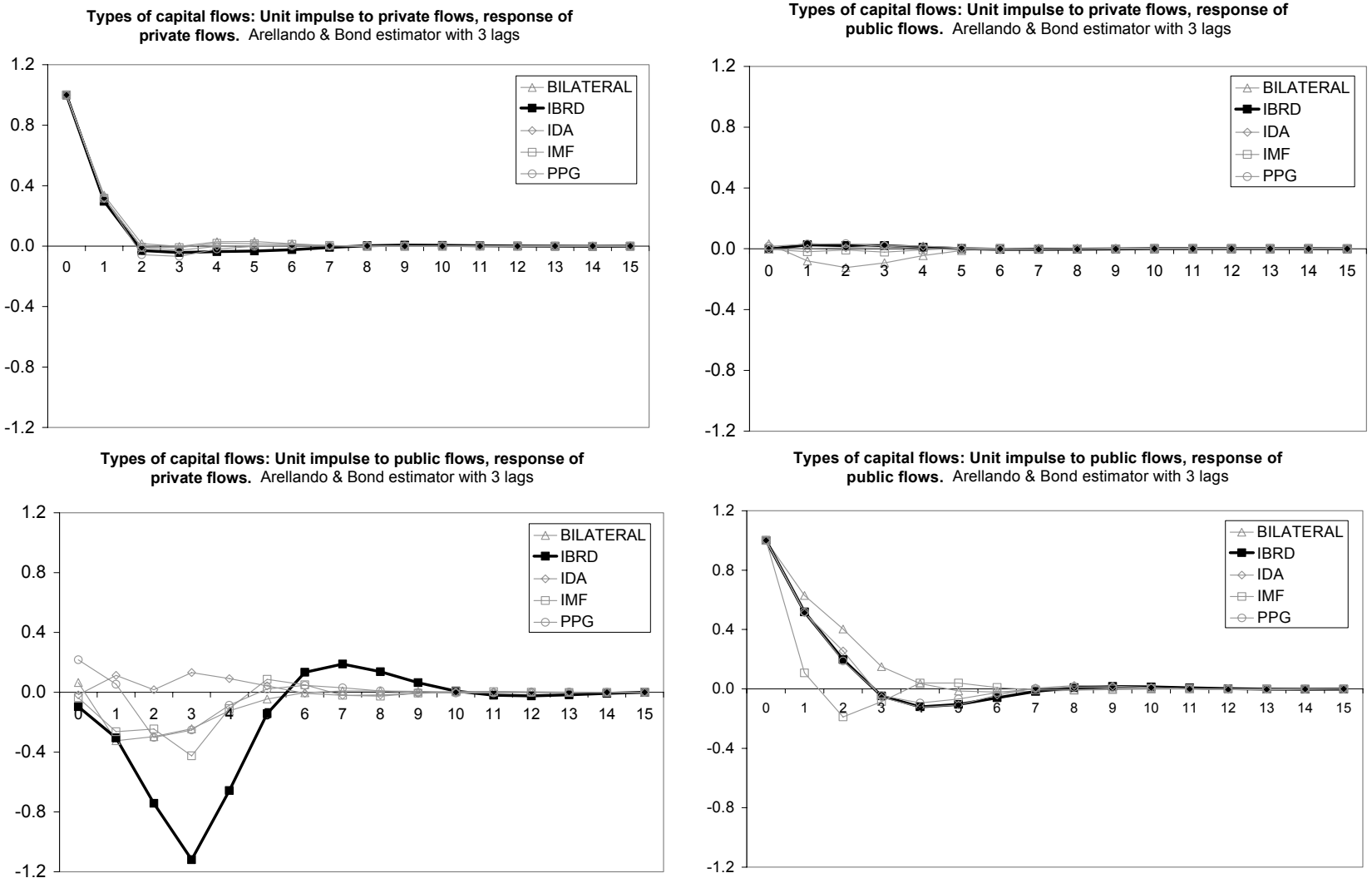


Table 5. VAR including domestically-owned capital, Arellano and Bond Estimator

Regressand:	$PRIV_t$			$PUBL_t$			$DIFD_t$		
$PRIV_{t-1}$	0.423	0.380	0.293	0.026	0.021	0.027	0.594	0.608	0.665
	(9.18)	(7.43)	(4.94)	(3.87)	(2.82)	(2.78)	(5.83)	(5.35)	(4.86)
$PRIV_{t-2}$		–0.163	–0.188		0.00320	–0.00193		–0.348	–0.141
		(–3.86)	(–4.21)		(0.43)	(–0.22)		(–3.19)	(–1.24)
$PRIV_{t-3}$			0.0111			0.00851			0.306
			(0.25)			(0.96)			(2.48)
$PUBL_{t-1}$	–0.562	–0.581	–0.377	0.491	0.478	0.506	–2.23	–1.47	–1.74
	(–2.07)	(–2.08)	(–1.30)	(12.27)	(11.39)	(9.68)	(–3.58)	(–2.23)	(–2.42)
$PUBL_{t-2}$		0.00116	–0.391		–0.0413	–0.0660		0.557	1.18
		(0.00)	(–1.44)		(–0.98)	(–1.36)		(0.81)	(1.73)
$PUBL_{t-3}$			–0.560			–0.111			0.0979
			(–1.69)			(–1.96)			(0.12)
$DIFD_{t-1}$	0.0812	0.0986	0.105	0.00405	0.000816	0.000439	0.635	0.506	0.400
	(3.99)	(4.53)	(4.70)	(1.24)	(0.23)	(0.11)	(7.45)	(4.78)	(3.07)
$DIFD_{t-2}$		–0.0366	–0.0143		0.00264	0.000835		–0.152	–0.191
		(–1.60)	(–0.64)		(0.71)	(0.20)		(–2.84)	(–3.30)
$DIFD_{t-3}$			0.00472			–0.00510			0.0543
			(0.19)			(–1.09)			(0.92)
Constant	0.00130	–0.0000435	–0.00101	–0.000457	–0.000518	–0.000631	–0.000469	–0.00174	0.00190
	(2.63)	(–0.08)	(–1.49)	(–5.43)	(–5.32)	(–4.76)	(–0.42)	(–1.20)	(0.96)
N	734	611	506	734	611	506	726	604	499
Groups	122	105	102	122	105	102	121	105	100
F-test of H_0: *PUBL* does not Granger cause the dependent variable									
F statistic	4.29	4.4	8.44	_	_	_	12.8	5.14	7.24
p value	0.038	0.111	0.038				0.000	0.076	0.065
F-test of H_0: *DIFD* does not Granger cause the dependent variable									
F statistic	16.0	20.8	22.5	1.54	0.690	1.23	_	_	_
p value	0.000	0.000	0.000	0.215	0.710	0.746			
F-test of H_0: *PRIV* does not Granger cause the dependent variable									
F statistic	_	_	_	15.0	8.45	7.73	34.0	35.1	24.1
p value				0.000	0.015	0.052	0.000	0.000	0.000
Arellano and Bond test of H_0: No 2nd-order autocorrelation									
F statistic	–2.83	–0.330	0.160	–0.420	0.590	2.23	–1.90	–0.600	–0.720
p value	0.005	0.742	0.873	0.672	0.555	0.026	0.058	0.549	0.472
F-test of H_0: Coefficients on final included lags of *PRIV*, *PUBL*, and *DIFD* all jointly = 0									
F statistic	90.0	15.5	2.99	69.6	1.40	6.57	82.2	16.1	6.13
p value	0.000	0.001	0.393	0.000	0.705	0.087	0.000	0.001	0.106

PRIV is net private capital inflows as a percentage of GDP. *PUBL* is IBRD disbursements minus principal repayments as a percentage of GDP. *DIFD* ("Domestic Investment Financed Domestically") is the domestically-owned portion of GDI, calculated as GDI less net foreign capital inflows of all types, as a percentage of GDP. Length of panel is T = 9, covering 1971-1998, where each time period represents cumulative capital flows during three years. *t*-statistics are reported in parentheses below each coefficient estimate.

Figure 6. Impulse-response functions including domestically owned capital

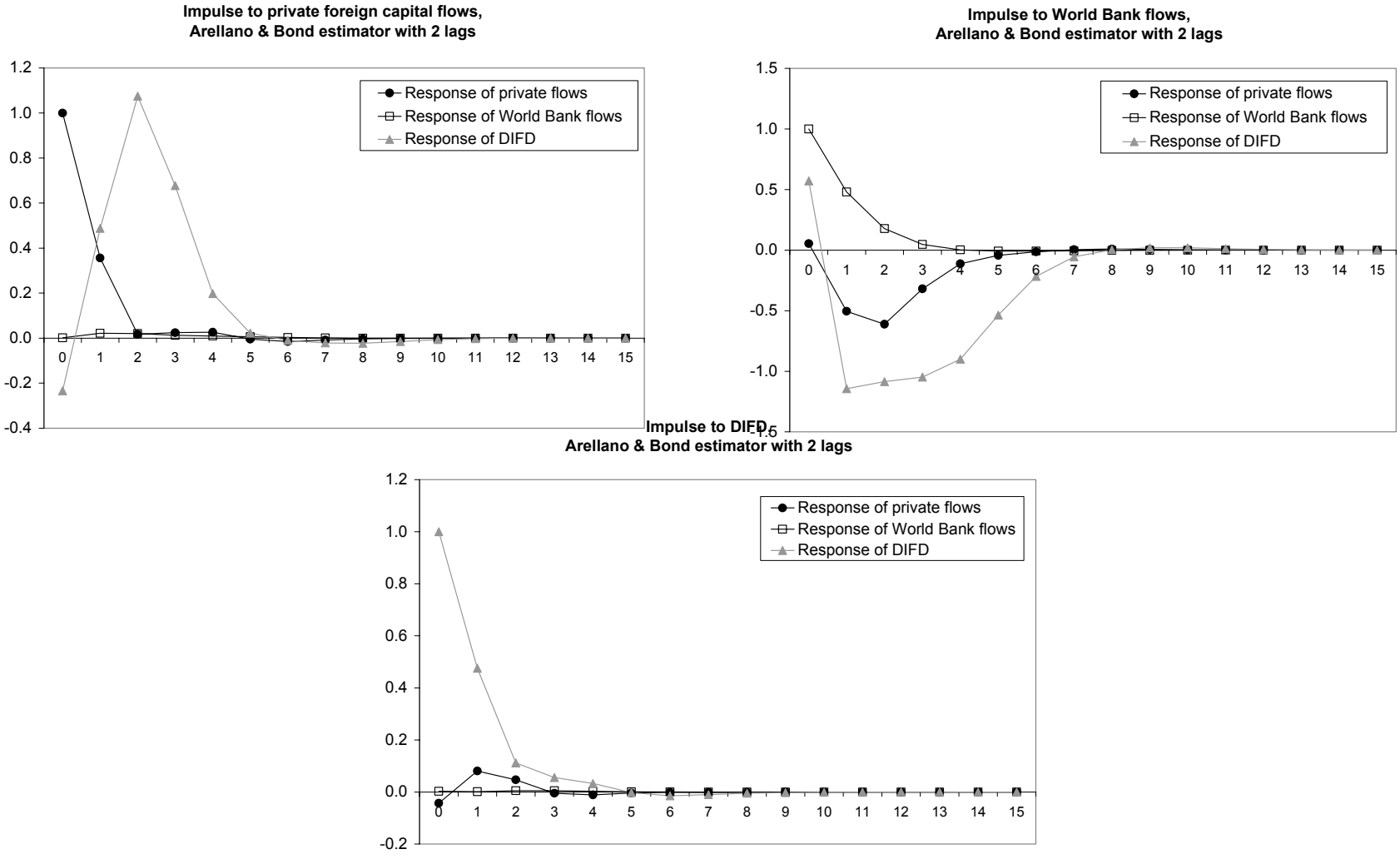
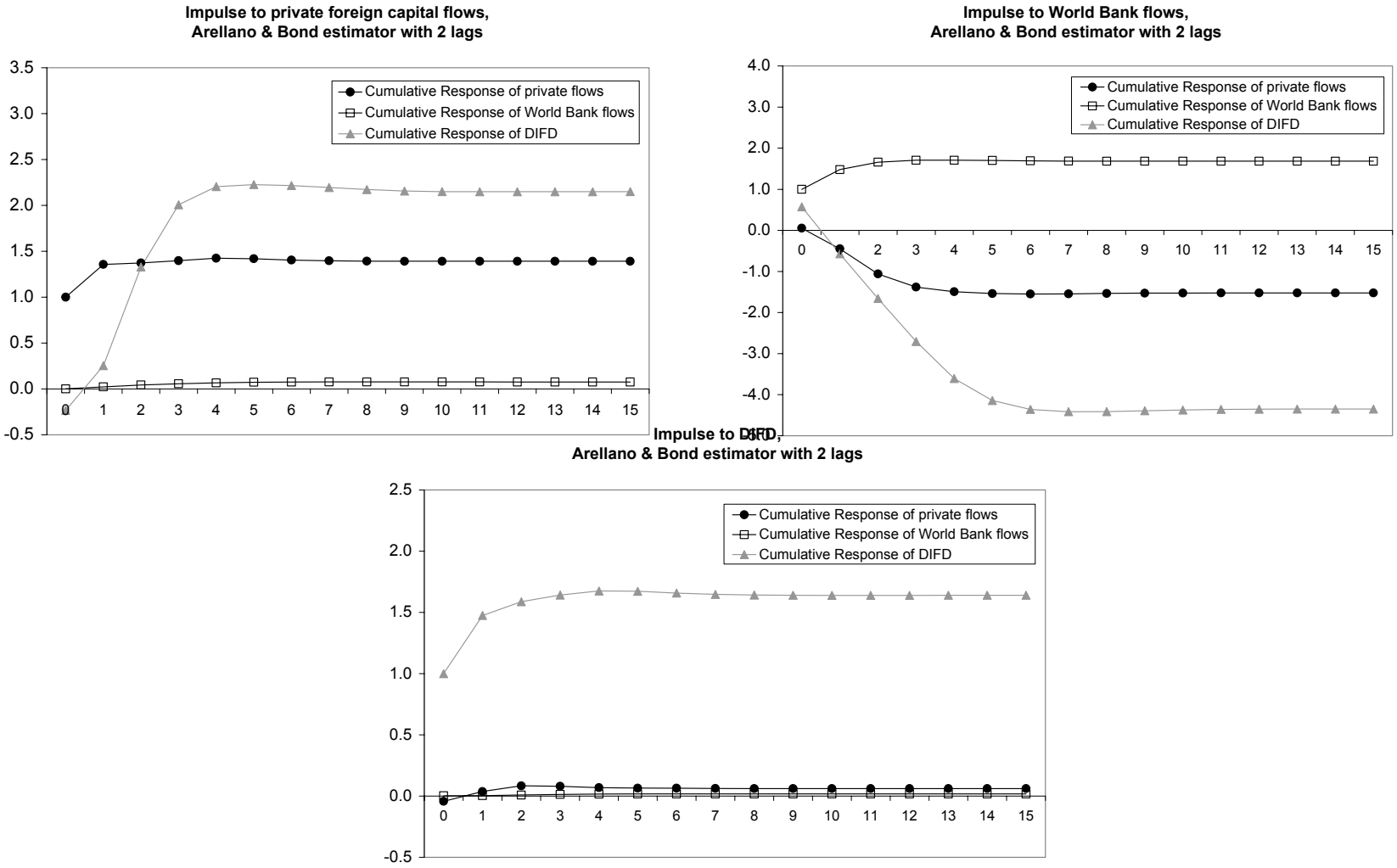


Figure 7. Cumulative impulse-response functions including domestically owned capital



Appendix: Data sources and definitions

All data on capital flows used in the empirical analysis come from the World Bank. Figures for current Gross Domestic Investment (in the source, Gross Domestic Capital Formation GDICURR) and current Gross Domestic Product (GDPCURR) come from International Bank for Reconstruction and Development (2001), *World Development Indicators 2001*, CD-ROM (Washington, DC: The World Bank). All other data on capital flows come from International Bank for Reconstruction and Development (2000), *Global Development Finance 2000*, CD-ROM (Washington, DC: The World Bank). The following definitions of terms are direct quotations from these sources.

- *Net private capital inflows* (NFAPRVT): "Private net resource flows are the sum of net flows on debt to private creditors (both public/publicly guaranteed and non-guaranteed) plus net direct foreign investment and portfolio equity flows. Net flows are disbursements minus principal repayments."

- *Net IBRD inflows* (NFLMIBR): "Public and publicly guaranteed debt outstanding from the International Bank for Reconstruction and Development (IBRD) is nonconcessional. Nonconcessional debt excludes loans with an original grant element of 25 percent or more. Net flows are disbursements minus principal repayments."

- *Net IDA inflows* (NFLMIDA): "Public and publicly guaranteed debt outstanding from the International Development Association (IDA) is concessional. Concessional debt is defined as loans with an original grant element of 25 percent or more. The grant equivalent of a loan is its commitment (present) value, less the discounted present value of its contractual debt service; conventionally, future service payments are discounted at 10 percent. The grant element of a loan is the grant equivalent expressed as a percentage of the amount committed. It is used as a measure of the overall cost of borrowing. Net flows are disbursements minus principal repayments."

- *Net bilateral inflows* (NFLBLAT): "Bilateral debt includes loans from governments and their agencies (including central banks), loans from autonomous bodies, and direct loans from official export credit agencies. Net flows are disbursements minus principal repayments."

- *Net inflows of private credit to governments* (NFLPRVT): "Public and publicly guaranteed debt from private creditors include bonds that are either publicly issued or privately placed; commercial bank loans from private banks and other private financial institutions; other private credits from manufacturers, exporters, and other suppliers of goods; and bank credits covered by a guarantee of an export credit agency. Net flows are disbursements minus principal repayments."

- *Net IMF inflows* (period-to-period change in DODDIMF): "This variable was calculated as the period-to-period change in outstanding obligations to the IMF. Use of IMF credit denotes repurchase obligations to the IMF with respect to all uses of IMF resources, excluding those resulting from drawings in the reserve tranche. It is shown for the end of the year specified. It comprises purchases outstanding under the credit tranches, including enlarged access resources and all of the special facilities (the buffer stock, compensatory financing, extended fund, and oil facilities), Trust Fund loans, and operations under the Structural Adjustment and Enhanced Structural Adjustment facilities. Purchases are total

drawings on the General Resources Account of the IMF during the year specified, excluding drawings in the reserve tranche. Repurchases are total repayments of outstanding drawings from the General Resources Account during the year specified, excluding repayments due in the reserve tranche. To maintain comparability between data on transactions with the IMF and data on long-term debt, use of IMF credit outstanding at the end of year (stock) is converted to dollars at the SDR exchange rate in effect at the end of year. Purchases and repurchases (flows) are converted at the average SDR exchange rate for the year in which transactions take place. Net purchases will usually not reconcile changes in the use of IMF credit from year to year. Valuation effects from the use of different exchange rates frequently explain much of the difference, but not all. Other factors are increases in quotas (which expand a country's reserve tranche and can thereby lower the use of IMF credit as defined here), approved purchases of a country's currency by another member country drawing on the General Resources Account, and various administrative uses of a country's currency by the IMF."

The sample of countries is Albania, Algeria, Angola, Argentina, Armenia, Azerbaijan, Bangladesh, Barbados, Belarus, Belize, Benin, Bhutan, Bolivia, Bolivia, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Republic, Chad, Chile, China, Colombia, Comoros, Congo (Dem. Rep.), Congo (Rep.), Costa Rica, Côte d'Ivoire, Croatia, Czech Republic, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt (Arab Rep.), El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Fiji, Gabon, Gambia (The), Georgia, Ghana, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, India, Indonesia, Iran (Islamic Rep.), Jamaica, Jordan, Kazakhstan, Kenya, Korea (Rep.), Kyrgyz Republic, Lao PDR, Latvia, Lebanon, Lesotho, Liberia, Lithuania, Macedonia (FYR), Madagascar, Malawi, Malaysia, Maldives, Mali, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Morocco, Mozambique, Myanmar, Nepal, Nicaragua, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Romania, Russian Federation, Rwanda, Samoa, São Tomé and Principe, Senegal, Seychelles, Sierra Leone, Slovak Republic, Solomon Islands, Somalia, South Africa, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Swaziland, Syrian Arab Republic, Tajikistan, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Uganda, Ukraine, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Yemen (Rep.), Yugoslavia (FR, Serbia and Montenegro), Zambia, and Zimbabwe.

The data on private capital flows displayed in Figure 1, but not those used in the empirical analysis, come from International Monetary Fund (2000), *International Financial Statistics*, CD-ROM version 1.1.54 (Washington, DC: The International Monetary Fund). Original figures are converted into constant 1996 dollars via a deflator from release 6.0 of the *Penn World Tables*, better known as the Summers and Heston dataset, disseminated by the Center for International Comparisons at the University of Pennsylvania. IMF figures are used for this figure (alone) because it is therein desirable to include developed nations for contrast; the World Bank figures, much more suitable for all the subsequent empirical analysis, cover only the developing world.

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