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Exchange Rate Arrangements in the Transition to East African Monetary Union

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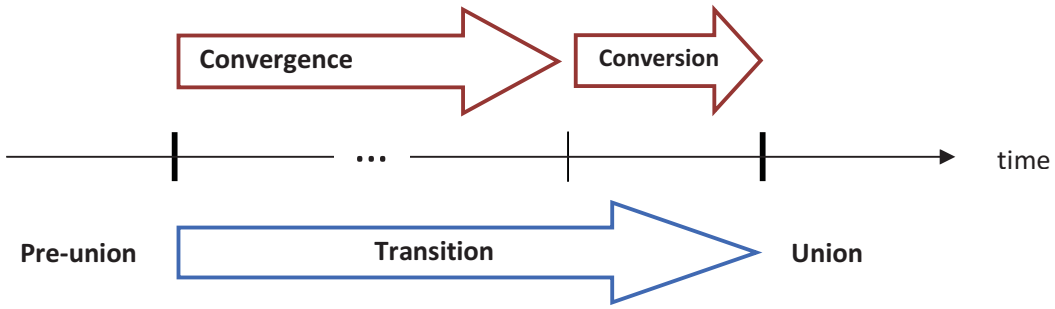
1. Introduction

This report considers alternative exchange rate arrangements for EAC countries in the transition to a monetary union. Four main considerations shape our analysis.[1] First, while existing exchange rate policies differ in some important ways across the EAC, the Partner States have expressed a desire to achieve a common exchange rate policy during the transition to union. Second, since the transition period is of uncertain duration, the exchange rate arrangements adopted during the transition should be consistent with macroeconomic stability and financial development on a country-by-country basis. Third, the exchange rates at which national currencies are converted to the new union-wide currency should be consistent with macroeconomic stability, both in the final run-up to union and in the first few years of union. Finally, the transition period should be long enough to lay the institutional groundwork for a successful and durable monetary union.

We conceptualize the transition to union as a two-phase process. In an initial **convergence phase**, the Partner States work to achieve a set of preconditions designed to limit the union's exposure to internal economic strains. These include macroeconomic convergence criteria and explicit understandings on surveillance mechanisms and fiscal responsibilities post-union.[2] The duration of this phase is uncertain, because it depends on the pace at which the member states can put the requisite preconditions in place. When the preconditions have been satisfied, the partners may choose to enter the final, **conversion phase**, marked by the announcement of a predetermined date for union.

Figure 1 *The transition to monetary union*



[1] In addition to a 'uniform geometry' or 'one-speed' transition, in which all members enter the union at the same time. We do not consider variable geometry in this report.

[2] These issues are taken up in IMF (2012a), a study commissioned by the MAC that focuses on questions of macroeconomic convergence. IMF (2012b) focuses on the design of a common monetary framework and a harmonized communications strategy for EAC central banks, and a third MAC-commissioned paper discusses the development of a common basis for the generation of relevant statistics. See EAC Secretariat (July 2010) for an outline of the work program commissioned by the MAC.

Our analysis suggests that the appropriate exchange rate policies for EAC countries differ across the two phases of the transition.

- For the bulk of the transition – the entire convergence phase – we favor a policy broadly consistent with that currently in operation across the EAC, in which national exchange rates are market-determined and central banks intervene to smooth volatility rather than to influence the medium-run path of the exchange rate. In moving towards such an arrangement, the smaller countries of the zone should be prepared to tolerate larger short-run movements in the exchange rate than at present.

- Exchange rate commitments should become prominent only in the final, irrevocable stage of the move to union, and this phase should be brief. The partner countries enter this stage by announcing a fixed date for union and an irrevocable set of parities at which national currencies will be exchanged for the East African Currency Unit (EACU) at the date of union. National central banks commit to keep their currencies within a predetermined band of these conversion parities in the period leading up to union. National currencies may continue to circulate for retail transactions purposes at the conversion parities for a year or more post-union, before being removed from circulation.

The remainder of the report develops these recommendations in detail. We begin in Section 2 by framing the analysis with reference to the European experience, which is the only contemporary example of long-established national currencies making a transition into a multi-country monetary union. Section 3 reviews current exchange rate policies in the EAC, along with other initial conditions relevant to our analysis. Section 4 lays out exchange rate options for the convergence phase, and presents our argument in favor of flexible exchange rates and money or inflation anchors. Section 5 focuses on the conversion phase, including the establishment of an EACU, the choice of conversion rates, and the adoption of a temporary grid-plus-band system for intra-union exchange rates. Section 6 addresses the institutional requirements for a successful transition to union, and in Section 7 we discuss the risks of a premature transition. We conclude the report with a summary of findings and recommendations.

2. Analytical context

This section addresses briefly the underlying motivations for monetary union, the logic of convergence criteria during and after the transition, and the relevance of the European experience.

Countries enter into monetary unions for three main reasons, the balance of which may vary even across partners within a given union:

- To promote trade and financial integration with union partners and the rest of the world.
- To improve the quality of monetary and exchange rate policy.

- To accelerate a process of union-wide political integration.

The first of these motivations is virtually always present and is a crucial part of the motivation for union in the EAC. The second is particularly relevant for countries with histories of monetary instability: these countries may view the delegation of policy to a supra-national authority as a way to reduce inflation bias and promote greater macroeconomic stability. The final consideration was prominent in the European case, and has typically played a role in the stated motivations for proposed monetary unions in Sub-Saharan Africa.

Whatever the mix of considerations in particular cases, however, the benefits of union come at the cost of a loss of policy sovereignty for each member state. National central banks become subordinate to a union-wide central bank, where decisions on liquidity, interest rates, and exchange rates may reflect the relative economic weight of the members but will rarely be driven by the preferences of any single member. Key policy instruments – particularly exchange rates and discount rates – automatically become union-wide, while others, notably on the fiscal side, remain within the domestic domain but may be heavily circumscribed by union-wide considerations.

As the recent experience of the Euro zone illustrates, the loss of monetary sovereignty becomes costly when some union members develop policy preferences that diverge sharply from those of other members. Countries experiencing economic slack may favor monetary easing, for example, while those experiencing rising inflation may favor tightening. Countries facing external competitiveness problems may favor a weak exchange rate while other countries have no need for devaluation. Countries with severe fiscal challenges may favor more generous monetary finance than those closer to fiscal balance. In each case, policy tensions – and the associated costs of union – are greater when country-level economic environments differ more sharply across the union. For this reason, economic convergence is a central concept in both the formation and maintenance of a successful monetary union.[3]

The most important components of convergence, in our view, are commitments to fiscal discipline and debt sustainability. Quantitative benchmarks should be achieved in these areas prior to the entry into monetary union, and a surveillance mechanism should be put in place both to prevent costly divergences once the union has been formed and to allocate fiscal responsibilities in the event a fiscal or debt crisis does occur. A system of union-wide prudential regulation of capital flows and the financial system is also important, given the proliferation of cross-border risks associated with greater financial integration.

The experience of the Euro zone looms large in our analysis, both as the single contemporary example of a monetary union formed from independent national currencies and, more recently, as a cautionary tale

[3] Economic flexibility is a second key concept: the loss of policy sovereignty is less costly when labor markets can adjust rapidly to asymmetric economic shocks within the union, and/or when non-monetary policy instruments (e.g., fiscal policy) can be deployed to facilitate adjustment. For a thorough overview of the literature on monetary unions, see De Grauwe (2009) and Beetsma and Giuliodori (2010). Durevall (2011) reviews the literature from the perspective of the EAC.

on the dangers of economic divergence once a union is established. Two key differences, however, limit the direct relevance of Europe's experience for the EAC. The first is while the European countries began their transition period soon after the collapse of the Bretton-Woods system of adjustable pegs, the large countries of the EAC have been operating flexible exchange rates for well over a decade. Thus while tight exchange rate commitments were a natural feature of Europe's transition, it is not obvious that they are appropriate for the EAC. The second difference is less clear in its implications, and relates to the importance of external donors in the fiscal affairs of low-income countries. In four of the five EAC economies, donors have provided substantial debt stock relief in the past decade and continue to finance large portions of the public budget. Whether the prospect and/or pattern of development assistance will reduce or exacerbate the macroeconomic tensions associated with monetary union is unclear. The importance of official donors and creditors does suggest, however, that discussions of fiscal responsibilities post-union should take proper cognizance of the burden-sharing – or burden-creating – role of external donors.[4]

A final aspect of Europe's experience may be more important for shaping the EAC's transition than it first appears. This is the impact of the global financial crisis in exposing severe macroeconomic divergences within the Euro zone. The fiscal and external debt problems of the peripheral countries have proven severe enough to shake their own commitments to monetary union as well as those of some of the larger countries. This is despite a convergence process that occupied nearly three decades, conferred substantial political legitimacy on supra-national policymaking bodies, and featured explicit fiscal convergence criteria. At one level, this observation merely reinforces the need for explicit, appropriate and enforceable agreements on fiscal discipline and aggregate debt sustainability. At another, however, it raises the credibility stakes for any new monetary union. It remains to be seen whether the Euro zone will emerge intact. Even if it does, however, the notion that membership status may be reversible raises new questions during the transition to union. This is of potential concern in the EAC, where despite impressive achievements since the re-establishment of the community in 2000[5], the political legitimacy of union-wide authorities is less well established than it was in the Euro zone. In European case the European Parliament, the Commission and other supra-national institutions predated the European Central Bank. Quite independently of other considerations, therefore, the credibility of an EAC central bank – and of the union itself – may be on a weaker footing at the outset than in the case of the Euro zone. We return to this point below in discussing the dangers of a premature move to union.

[4] The IMF provides ongoing technical support and surveillance of monetary policy in all five countries, a role that will surely continue post-union, both at the union level and individually.

[5] Following the dissolution of the original East African Community in 1977, the community's present trajectory began as early as 1993, with the establishment of a Permanent Tripartite Commission among the original three members. Burundi and Rwanda joined the community in 2007. The East African Court of Justice and East African Legislative Assembly were established in 2001. The Customs Union was established in 2005, and a Common Market Protocol was adopted in 2009.

3. Exchange rate policies and initial conditions

This section reviews existing exchange rate policies in the EAC and discusses initial conditions that play a role in shaping our recommendations. The context for current exchange rate policies dates from the mid-1990s, when the three large countries of the EAC adopted their current systems of managed floating. The move to managed floating in Kenya, Tanzania and Uganda was part of a set of reforms designed to establish unified and market-determined exchange rates by eliminating distortionary systems of foreign-exchange rationing and developing an inter-bank market for foreign exchange. Uganda and Kenya liberalized their exchange controls very substantially in the mid-1990s, dismantling controls on the capital account as well as the current account. Tanzania liberalized fully on the current account but has only recently begun to liberalize its capital controls as part of harmonization efforts within the EAC. It is highly likely – though not inevitable – that the monetary framework adopted by the union-wide central bank will be close in outline to the framework currently operated in the three large countries, with a flexible, market-determined exchange rate and a largely open capital account. Burundi and Rwanda appear to be on a gradual path to such a regime, and would be likely to continue on this path even in the absence of monetary union.

3.1. Exchange rate policies

Table 1 provides a succinct summary of foreign exchange market arrangements and operating procedures in the EAC.[6] The key features of this summary are as follows:

- Four of the five EAC countries are formally committed to exchange-rate convertibility for current account purposes.[7] There are differences across countries, however, in *de facto* exchange rate flexibility, stringency of capital controls, and sophistication of interbank foreign exchange markets.

- In its classification of *de facto* exchange rate regimes, the IMF characterizes Kenya, Tanzania and Uganda as practicing *managed floating*, Rwanda as operating a *crawl-like* regime, and Burundi as operating a *stabilized* regime (as of 2011). These differences in exchange rate flexibility are apparent – particularly over the past few years – in Figure 2, which tracks EAC exchange rates against the US dollar over the past decade.

- Kenya, Uganda and Tanzania deploy comparable operational procedures for exchange rate management. The authorities commit to a floating exchange rate whose value is determined in the interbank foreign exchange market and structure their foreign exchange operations around reserve coverage and liquidity management objectives established in their reserve money

[6] The evidence in Appendix Table 1 is based primarily on interviews conducted by the authors in each of the five Central Banks between 7 and 14 January 2011, supplemented by data from various IMF and other sources.
[7] Dates of accession to Article VIII status in the IMF are: Kenya and Uganda 1994, Tanzania 1996 and Rwanda 1998. Burundi has not yet ratified Article VIII.

programmes. The reserve money programmes are, in turn, anchored on an explicit target for inflation.

- These arrangements are not yet fully in place in Rwanda and Burundi, but both countries are working to develop interbank foreign exchange markets and are moving in the direction of greater exchange rate flexibility.

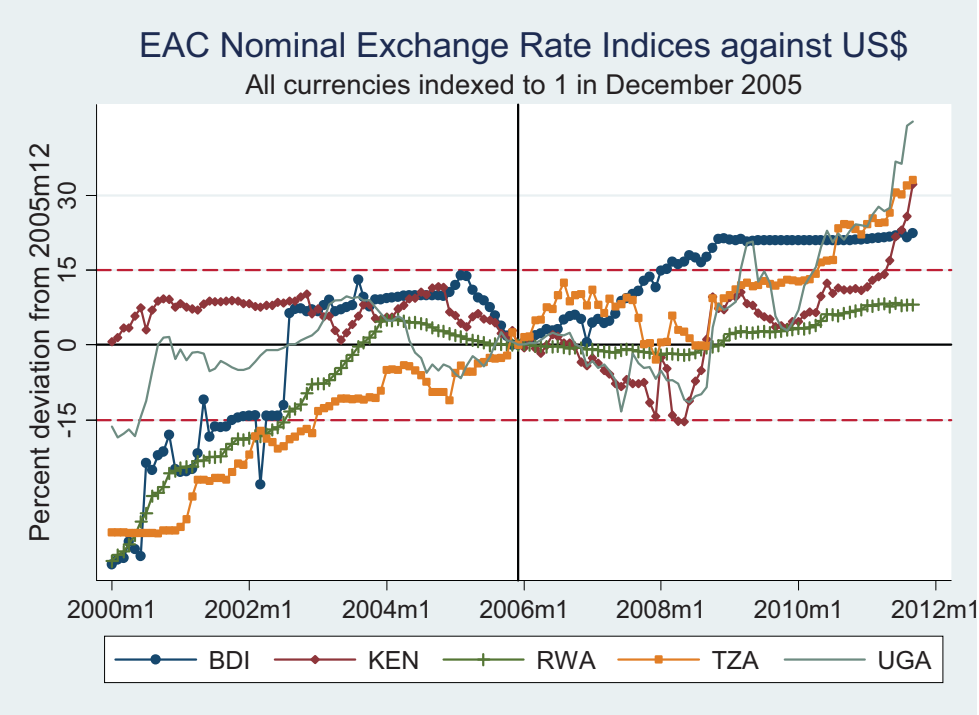
- These cross-country differences in exchange-rate management are reflected in the structural characteristics of the foreign exchange markets. In Kenya, Uganda and Tanzania, the markets are perceived to be broadly competitive while the central banks are important but not decisive player in the market. Central banks may seek to trim short-run volatility in the market but would not normally expect to be able to decisively influence the underlying rate. In Rwanda and Burundi, where foreign aid flows to government account for around half of all foreign exchange inflows, and where the private financial sector is less developed, the central banks are the decisive players and, to a large degree, still the market makers.

An important corollary of the differences noted here is that private capital flows would be expected to represent a more substantial source of latent exchange market pressure in Kenya and Uganda than elsewhere. Residual controls on the capital account in Tanzania and the lower levels of financial sector and capital market development in Rwanda and Burundi would suggest that these countries continue to experience significant insulation from portfolio capital flows and the associated risk of the build-up of speculative pressures on the currency. As we will see in the next section, these differences are apparent in indirect measures of capital mobility, although they do not show up strongly in direct comparisons of the volume of private capital flows.

3.2 Capital controls and short-term capital mobility

Portfolio behavior is a potentially powerful source not only of day-to-day pressures in foreign exchange markets but also of speculative attacks that can test a central bank's commitment to a fixed exchange rate. These attacks can be costly for the economy whether they succeed or fail, because a successful attack produces a large devaluation, with its impact on inflation, external debt burden, and central bank credibility, while a failed attack may require an aggressive monetary policy response that damages the domestic economy via very high interest rates. The celebrated *trilemma* proposition in international macroeconomics states that in the presence of high capital mobility, a central bank must choose between exchange rate targets and domestic targets for monetary policy: it cannot sustain strong exchange rate commitments unless it is prepared to abandon domestic objectives when required to defend the exchange rate. This reasoning is one of the influences behind Kenya and Uganda's move to exchange rate flexibility in the 1990s, at a time when they were also choosing to open their capital accounts. Regardless of the other merits of flexible exchange rates – for example, in supporting exchange rate unification and allowing rapid adjustment of the real exchange rate to terms of trade shocks – a flexible rate was thought necessary to support the country's commitment to an open capital account.

Figure 2 *EAC exchange rates*



Notes: The figure shows log differences relative to 2005m12, multiplied by 100 to convert into approximate percentage differences. Source: IMF, International Financial Statistics.

Concerns about the trilemma also apply, of course, to exchange rate commitments during the transition to monetary union. Once union is consummated, intra-union exchange rates are eliminated as potential sources of speculative capital flows. But during the transition, the advisability of tight exchange rate commitments depends on the degree to which these commitments may be exposed to speculative attack. This in turn depends on the degree of *de facto* capital mobility on a country-by-country basis. We develop both direct and indirect evidence on this question.

The direct measures appear in Section 4 of Appendix 1. We report the Chinn-Ito (2008) measure of *de jure* openness, which is based on the prevalence of legal restrictions on the capital account, along with a pair of measures of *de facto* openness, based on the reported volume of private capital flows. *De jure* openness varies quite substantially across the EAC, with Burundi in the least open group on a global basis in 2009 and Uganda in the most open group. By comparison with non-industrial countries, Burundi was in the 7th percentile in 2009, Rwanda and Tanzania in the 44th (along with South Africa), Kenya in the 68th, and Uganda in the 100th.[8] These differences are not strongly reflected, however, in the volume of gross private capital flows. While all EAC countries except Tanzania have experienced at least a modest trend increase in gross flows in recent years, these flows remain small both in absolute terms and by the

[8] These observations refer to the IMF's classification in its annual *Exchange Arrangements and Exchange Restrictions*; 2009 the latest available. Rwanda has recently liberalized capital flows very substantially; see Appendix Table 1.

standards of other countries in Sub-Saharan Africa. They also differ by less across the countries of the EAC than might be expected given their sharp differences in *de jure* openness.

A second, indirect form of evidence about capital mobility comes from measures that assess the degree to which monetary policy is constrained by short-term capital movements. In Appendix 2 we estimate the dynamic response of foreign exchange markets to changes in monetary policy on a country-by-country basis. These results suggest that there is significant exposure to short-term capital mobility in the EAC, particularly in the larger countries.

In interpreting these varied results, we place weight on the increasing sophistication of interbank markets in the EAC countries, and also on the recent liberalization of capital controls within the EAC itself. While the EAC countries are well short of the trilemma, their scope for maintaining tight exchange rate commitments while simultaneously pursuing domestic monetary policy objectives is limited. This is particularly true for Kenya and Uganda, but as capital movements become freer within the EAC, portfolio capital will be able to move between each member and global markets indirectly, via transit through partners whose capital accounts are more open vis-à-vis the rest of the world. As in the case of a free trade area without a common external tariff, the *de facto* exposure of each participant to external markets will tend to converge to that of the most open partner.

4. Exchange rate options for the convergence phase

Figure 1 divides the transition period into a convergence phase and a conversion phase. We argue in Section 5 that central banks should be prepared during the latter phase to defend their exchange rates within relatively narrow bands around the announced conversion parities. To reduce the scope for speculative attacks or asymmetric changes in the real exchange rate fundamentals, the conversion phase should be short – perhaps two calendar quarters at most.

The convergence phase, by contrast, is of uncertain duration. Exchange-rate policies for this phase should therefore be consistent with the successful conduct of monetary policy for a potentially extended period. In analyzing the options, we place a particular emphasis on the transparency of alternative arrangements, their suitability for the EAC countries, and how they anchor inflation. We assume that regardless of the option chosen, countries will work during the convergence phase to deepen market integration and harmonize financial market regulations.

Should nominal exchange rate commitments – in particular, convergence criteria for intra-union nominal exchange rates – play a central role in the lead-up to monetary union? The complete elimination of intra-union exchange rates is of course the single most obvious consequence of adopting a common currency, and the appropriateness of this commitment plays a central role in the theory of optimal currency areas. In Europe, moreover, where the convergence phase spanned nearly three decades, nominal exchange rate commitments played a prominent role through the entire transition process. The exchange rate mechanism (ERM) specified a grid of bilateral central exchange rates between the potential partners and a set of country-specific bands within which exchange rates were

allowed to fluctuate. The central rates could be adjusted by mutual agreement, but for the two years leading to entry countries were not to devalue their central rates, and were to manage their economies so as to remain within a ±2.5% band of the parities without experiencing severe pressure. The central rates ultimately served as conversion rates: in May 1998, the entering members announced that they would convert to the euro on 1 January 1999, at the prevailing central rates. At the time of the announcement, no member was more than ½ of 1 percent from its central parity. Subsequent movements gradually closed the gaps to zero in the weeks and days before conversion.

Not surprisingly, an agreement to limit cross-country exchange rate movements during the transition period features prominently in the ECB study of the prospective East African monetary union.[9] A mutual grid is also a feature of the transitional arrangement among the countries of the Gulf Cooperation Council (GCC). But the advisability of such a scheme for the EAC countries is not obvious. Unlike either the European countries or the GCC members, who were on pegged arrangements before entering the transition period, the three large countries of the EAC operate *de facto* flexible exchange rate regimes and have done so for some time. The European grid, moreover, was subject to multiple speculative attacks during the transition, and while the Gulf states have been largely free of such concerns, their success in maintaining fixed pegs to the dollar predates the transition period and may be due in large part to an unusual combination of labor market flexibility and fiscal flexibility – a combination that is not reproduced in the EAC.[10] For these reasons we consider a range of options for the convergence phase, including one in which exchange rate commitments are absent altogether.

Independently of their exchange-rate histories, of course, any set of countries planning to enter a monetary union faces the looming elimination of intra-union exchange rates as a macroeconomic adjustment mechanism. This suggests two potentially important arguments in favor of formal convergence criteria for nominal exchange rates during the transition. The first is that limiting the flexibility of intra-union exchange rates may increase the flexibility of other national economic variables – wages and prices, labor mobility, fiscal policy – that will necessarily bear the brunt of addressing real exchange rate misalignments in the post-union period. The partners will therefore enter the union on a stronger footing for handling asymmetric shocks. The second is that a successful union requires a full understanding and acceptance by the Partner States of their impending loss of monetary sovereignty. Exchange-rate commitments, which by definition involve a reduction in monetary autonomy and may also involve explicit cooperation across partners, may provide a mechanism for ensuring that Partner States confront the implications of this transfer of sovereignty. As will become clear, we regard these considerations as important but not decisive for EAC countries.

Table 1 summarizes the five leading options for exchange rate management during the convergence phase. The options differ on two main – and related – dimensions. The first is the strength of exchange-

[9] ECB (2010).

[10] Willett *et al.* (2009) point out that the more than half of the labor force is composed of guest workers in a number of GCC countries. This affords an unusual degree of labor market flexibility. Oil wealth, in turn, affords an unusual degree of fiscal flexibility and obviates the need for active exchange rate management to maintain external balance.

rate commitments on a country-by-country basis and therefore the degree to which exchange rate commitments provide an anchor for inflation. The options here range from a managed float system in which countries make no exchange rate commitments, to an external grid system in which each country unilaterally pegs to a global currency. The second is the allocation of monetary policy autonomy across the union, defined in terms of the *de facto* locus of policy sovereignty and the scope for directing monetary policy to internal objectives like inflation or aggregate demand. Here the options range from a managed float system, in which sovereignty remains fully at the national level and flexible exchange rates allow considerable autonomy for monetary policy, to a collective anchor system, in which a supra-national institution acquires policy authority in advance of formal union, or an external grid system, in which sovereignty remains at the national level but an exchange-rate peg receives priority over internal objectives.

Table 1 *Options for exchange rate management during the convergence phase*

Option*	**Nominal anchor**	**Locus of monetary policy autonomy**
1 – Inflation Targets and ***Managed Float***	National money growth or inflation targets	National
2 – ***External Grid***	National exchange rate pegs	National (limited by peg)
3 – ***Delegated Anchor*** and Internal Grid	*Anchor country*: money growth or inflation *Others*: exchange rate peg to the anchor country	*Anchor country*: National *Others*: National (limited by peg)
4 – Inflation targets and ***Internal Grid***	National money growth or inflation targets, coexisting with limited flexibility of intra-EAC parities	National (limited by grid)
5 – ***Collective Anchor***	Collectively managed money growth and/or inflation targets, possibly coexisting with limited flexibility of intra-EAC parities	Shared (possibly limited by grid)

Notes: *The bold italics show descriptive short-hands for these options.

A final dimension that plays a role in our assessment is the transparency of these alternatives as monetary arrangements. Options 1-3 are high-transparency options, in the sense that the system as a whole is anchored by a set of intermediate targets that are unambiguous at the country level and can be achieved without explicit policy coordination. Options 4-5 are lower transparency in the sense of proposing multiple, and therefore potentially ambiguous nominal anchors at the country level. It is not clear that option 4, which lacks an explicit coordination mechanism, is stable. In the Euro zone, where the exchange rate commitments were taken seriously, option 4 evolved *de facto* into option 3. If

exchange rate commitments were not taken seriously, option 4 might evolve instead into a version of option 1, but with damage to the credibility of the union in the process. Option 5 proposes to resolve these ambiguities collectively, but is not transparent in terms of how the requisite transfer of sovereignty would be accomplished in advance of actual union. We now turn to the pros and cons of each option.

4.1 Option 1 – A managed float system

Our first option combines inflation targets with a managed float. This option is close to the status quo in the EAC. At present, none of the five EAC countries floats perfectly freely, but all but Burundi maintain a fairly clear hierarchy in which reserve money growth is the dominant inflation anchor and exchange rate intervention is mainly limited to smoothing short-run volatility.[11] In Burundi, the exchange rate appears to be managed more aggressively vis-à-vis the US dollar and the interbank foreign exchange market is in its infancy. But greater exchange rate flexibility could be accommodated in the auction market if the rate were to come under sustained pressure.

In a managed float system, therefore, countries continue to operate their existing frameworks, basing their monetary programs on a union-wide inflation target (with minimal adjustments to existing national targets, this could currently be 5 percent) and making no explicit commitments with respect to the medium term path for the exchange rate. Countries would pursue fiscal convergence as entry requirements, and would develop a set of union-wide fiscal safeguards to be operated post-union. They would work out the operational details of the post-union monetary framework and would put structures in place to increase information-sharing about the conduct of monetary policy.

Pros and cons of a managed float system

An important advantage to a managed float system is that it minimizes the disturbance to monetary frameworks that are currently in use in the EAC and that in most cases have performed successfully for over a decade. A managed float is not only robust to a potentially protracted convergence period, but also supports the continued development of domestic financial markets, and the continued refinement of existing policy frameworks, including moves towards inflation targeting. It also retains nominal exchange rate flexibility, a reality that traders and financial markets have become accustomed to in the larger countries of the community. Exchange rate flexibility has probably had some protective effect with respect to speculative movements against national currencies, and is likely to be retained as union-wide policy. In Burundi, where the inter-bank foreign exchange market is less developed and the authorities have been reluctant to allow exchange rate movements, the absence of exchange rate commitments during the transition period would provide an opportunity to continue to develop the inter-bank market, with a view to facilitating a gradual increase in exchange rate flexibility.

[11] Uganda is in process of implementing a formal inflation-targeting system, which will ultimately place significantly greater emphasis on inflation forecasts than on money growth rates as intermediate targets, and on policy interest rates rather than reserve money as operational instruments. Its exchange-rate policy will continue, however, to be a managed float.

It is possible, of course, that bilateral exchange rate movements may remain substantial even as countries coordinate their internal anchors, especially if countries are subject to asymmetric shocks. This is both an advantage and a potential disadvantage. On the positive side, a managed float system would facilitate external adjustment during the transition period, and might relieve the pressure on fiscal instruments that are constrained by entry requirements. On the negative side, flexible exchange rates may be subject to excess volatility, due to thin market effects or other sources of volatility unrelated to the fundamentals; these could raise potentially troublesome issues of misalignment at the conversion step.

A managed float system would also be subject to potential manipulation by partners seeking to enter the union with relatively weak exchange rates. Their objective in doing so would be to promote exports and to avoid a contractionary bias associated with overvaluation relative to union partners.[12] Behavior of this type could increase inflation bias at the national and union-wide levels during the transition period, with damaging credibility implications for the union. Alternatively, if members sought to reconcile real depreciation with low inflation, it could produce a high real interest rates and a contractionary bias during the transition, while potentially setting the partners up for an unsustainable post-union boom.[13]

A final and potentially serious concern about a managed float system is the flip side of its strongest advantage. By comparison with the other options, a managed float is a minimalist option for the EAC, not just in the sense of leaving existing anchors largely unchanged but also in the deeper sense of requiring the smallest sacrifice of monetary policy autonomy during the convergence phase. In a managed float system the national authorities agree on an inflation target but do not subordinate domestic objectives to exchange rate commitments and do not coordinate policy instruments explicitly during the convergence period. Such a system would preserve the strengths of existing national frameworks (especially for the large countries), and in that sense would be highly robust to uncertainties about the timing of the move to union. It would do little, however, to create, legitimize, and strengthen the union-wide institutions that will be fully responsible for policy from the conversion point forward. By the same token, it would do little to confront national stakeholders with the costs of union in terms of the inevitable loss of policy sovereignty. Because this option demands so little sacrifice of

[12] The export-promotion angle could operate either directly, via the competitiveness of exporting and import-competing firms in the regional and global markets, or indirectly, via competition within the union for footloose foreign direct investment in these sectors.

[13] The classic study of real exchange rate targeting is Calvo, Reinhart and Vegh (1995), who show that using monetary policy to target a depreciated real exchange rate for a temporary period requires some combination of higher inflation and higher real interest rates. The argument we are making here draws on Debrun, Masson and Pattillo (2005, 2010), who study a model in which governments are tempted to expand aggregate demand by devaluing relative to potential union partners. They argue that this temptation is an important reality in SSA and that it exerts a negative externality on potential partners. Our own argument is that real exchange rate targeting in advance of union would heighten this negative externality. While the act of union internalizes the externality (by eliminating intra-union exchange rates), the transitional damage to union-wide macroeconomic performance could undermine the credibility of the union.

sovereignty, Partner States must be more purposive in their investment in and commitment to EAC-wide institutions and the delegation of at least advisory functions to EAMI during the convergence period.

4.2 Option 2 – An external grid system

A centerpiece of the European transition was the establishment of a grid of central parities between national currencies and the European currency unit or ECU. The ECU itself was defined as a weighted average of the partner currencies. It follows that by committing to stay within a narrow band of the ECU, each country was in effect committing to keep its own exchange rate movements relative to the US dollar (or the deutschemark, or any other currency) close to those of its partners.

A decision by any group of countries to keep their exchange rates with respect to each other within a narrow (or narrow*ing*) band does not, in itself, provide an effective inflation anchor for any of the national currencies involved, or for any composite of these currencies: the anchor must be achieved by some supplementary mechanism. In regimes of mutual pegging, this is known as the *n*-1 currency *problem*: the proposition that mutual fixity among *n* partners determines only *n* – 1 exchange rates, leaving the relation of the group to external currencies indeterminate. Alternative grid systems provide the missing anchor in different ways. Our second and third options achieve this with high transparency, via an external grid or a delegated anchor system; our fourth option is essentially the one proposed in the ECB report, and is less transparent about how the system is anchored.

In an *external grid*, each country specifies a central rate against a global currency, such as the US dollar or the euro, and commits to keep its exchange rate within a predetermined band around this rate. In this arrangement, the bands provide an anchor for inflation on a country-by-country basis: when exchange rates approach the edges of the band, countries are effectively on a crawling peg. The central rates of course *imply* a grid of cross-rates between union currencies, and along with a set of fixed bands that will prevail as long as the individual central banks maintain their commitments vis-à-vis the global currency. The members of the Gulf Cooperation Council operate an external grid system. During the transition period, each member has committed to continuing its pre-existing peg to the US dollar. These pegs serve as country-by-country inflation anchors.

Pros and cons of an external grid system

On the positive side, an external grid provides a clear inflation anchor on a country-by country basis. If the grid is narrow (the European Exchange Rate Mechanism narrowed to 2.5% before union), the transition phase also provides an opportunity for countries to habituate themselves to the eventual elimination of cross-rates within the union. Severe strains at the country level can in principle be handled by temporarily widening a country's bands (as occurred on a number of occasions in the ERM) or adjusting the path of its central rates.

On the negative side, an external grid with a narrow band is the equivalent of a fixed but adjustable exchange rate regime. A wide band softens this equivalence, but only when the exchange rate remains within the band: when it moves to the edge of the band the country is on the equivalent of a fixed-but-

adjustable exchange rate regime. By comparison with hard pegs or flexible rates, adjustable pegs are known to be subject to speculative attack. We argued above that although capital mobility is far from perfect in EAC countries, it is sufficient to mean that explicit exchange rate commitments significantly limit domestic monetary and fiscal discretion.

The institutional histories of the EAC countries suggest additional disadvantages to adjustable peg systems. Unlike the GCC countries, the three large countries of the EAC definitively abandoned their adjustable peg regimes and have been operating flexible exchange rate regimes, in most cases since the mid-1990s. The reasons for this are various and include unfavorable experiences with exchange controls, vulnerability to substantial current account shocks, a desire for some degree of monetary autonomy in the context of an open capital account, and a desire to spur the development of domestic markets for exchange risk. As we noted earlier, Rwanda and Burundi are committed to moving in the same direction. Similar considerations seem likely to govern the choice of a union-wide framework for monetary policy, which will almost certainly feature a managed float for the EACU, anchored by a union-wide inflation target. For these reasons, an external grid – a reversion to fixed exchange rate regimes at the country level – seems an unlikely choice for countries making a transition from national managed floats to a union-wide managed float. Any disadvantages of such a choice, moreover, are greater in a context of uncertainty about the duration of the transition phase.

Given union-wide credibility spillovers, an external grid system would require a mechanism for coordinated foreign exchange intervention when a member's exchange rate reached the weak edge of its band. With capital mobility on the increase within the EAC, even a union-wide commitment to defend parities would be subject to speculative attack, and would therefore require strong complementary efforts to limit exposure to short-term capital movements.

4.3 Option 3 – A delegated anchor system

A common feature of our first two options is that neither involves an explicit mechanism for stabilizing cross rates among union partners. An external grid stabilizes these rates as a side effect of country-level links to the global currency, while a float leaves them tethered only by the commitment to a common inflation target. In a *delegated anchor* system, an internal grid emerges through individual pegs to the currency of a selected union partner. In this approach, the partners delegate one country from among them to maintain a strong domestic anchor. Each of the other countries then commits to keeping its own currency within a narrow (or narrowing) band of the delegated country's currency, with an arrangement for coordinated intervention when a member's rates go to the weak edge of the band. Within this system, the exchange rates of partner countries with respect to global currencies reflect those of the delegated currency. While the ERM is sometimes interpreted as a non-anchored grid (e.g., ECB 2010), it in fact operated as a delegated internal anchor system, with Germany providing the *de facto* delegated anchor.

Pros and cons of a delegated anchor system

A delegated anchor system has the advantage of assigning a clear inflation anchor to each country. The delegated country operates a domestically-anchored program of the type it has operated successfully in the past, one that targets money growth or an inflation forecast and is supported, as in all EAC countries at present, by a reserve-money program. As we have argued, such a framework is likely to be adopted by the EACB once the union is established. The remaining partners operate band-and-peg systems with respect to the anchor.

This system has two main disadvantages. The first is that the sacrifice of policy sovereignty is asymmetric. One country stands at the center of the system and enjoys monetary autonomy. Its role is to maintain a strong domestic inflation anchor, but as long as it accomplishes this function it has some degree of freedom to direct monetary policy to domestic ends. When economic shocks are asymmetric across partners, 'following the leader' may generate policy stances that are inappropriate to economic conditions in the partner economies. Moreover, if the delegated country fails to maintain a strong anchor its partners suffer the consequences, because they are in effect on a fixed bilateral exchange rate against the anchor country. This asymmetry may be politically difficult for the partners to accept, at least as an explicit arrangement. The second drawback is a version of our earlier point regarding the external grid system. None of the countries in the EAC is formally on a fixed or even heavily managed exchange rate, so for the majority of partners a delegated anchor system would represent a substantial temporary change in monetary framework. This drawback is more serious in the context of uncertainty regarding the likely duration of transition.

4.4 Option 4 – An internal grid system

Option 4 combines inflation targets at the country level with commitments to a grid of central parities for intra-union exchange rates. This option is closest to the formal structure of the European transition, and is the option favored in the ECB Report. At the level of nominal anchors, it is in principle well-specified: the internal grid provides $n - 1$ anchors, leaving one to be provided by a union-wide inflation target. The advantages of a well-anchored internal grid include those we mentioned earlier in this section: exchange-rate commitments may serve as a spur to greater economic and policy flexibility, and even more importantly, as a test of political commitment and institutional capacity-building.

Our major concern with the internal grid system is its lack of transparency. Absent some clear division of labor, each central bank is responsible for maintaining dual anchors: an inflation target simultaneously with a commitment to intra-union exchange rates. The European system resolved this ambiguity by evolving *de facto* into a high-transparency system: Germany pursued domestic objectives as the delegated anchor country, and the remaining countries pegged to the deutschemark. We have argued, however, that this *de facto* solution seems unlikely to acquire the legitimacy in the EAC it enjoyed in Europe. An alternative trajectory, where Partner States prove unwilling to defend the bands, might result in a version of Option 1, though with exposure to speculative attacks and considerable damage to credibility along the way.

4.5 Option 5 – A collective anchor system

Our first three systems– managed float, external grid, and delegated anchor – can in principle be implemented by national central banks with a minimum of intra-union coordination. Our final option is a *collective anchor* system that vests the authority for anchoring union-wide inflation in a supra-national body composed of representatives of the national central banks. In principle such an authority could devote either weak or strong attention to stabilizing cross-rates among union partners; the key is that the structure as a whole would be anchored indirectly through allegiance to money growth and/or inflation targets union-wide. A collective anchor system with intra-union exchange rate commitments would come closest to mimicking the monetary framework that is likely to prevail under the union, in which intra-union exchange rate changes will be absent and union-wide monetary policy will be formed through a collective process over which all members have some influence. A system without intra-union exchange rate commitments would be similar to our managed float option, but with significant policy sovereignty ceded immediately to a supra-national agency. The task of the supra-national body would be to coordinate national policies that continue to employ internal anchors (money growth rates, or inflation forecasts). Given the monetary frameworks currently in use in EAC countries, this might be accomplished by creating a zone-wide financial program to which the national reserve-money programs are subordinate in some well-defined sense.

Pros and cons of a collective anchor system

The advantages of a collective approach are associated with the partial transfer of authority to the supra-national level. Most prominent among these is a process of institutional maturation that should lead smoothly to the operation of a union-wide central bank. An additional benefit during the transition period may be a union-wide reduction in inflation bias, due to a dilution of national control over monetary policy instruments.

A potentially important disadvantage of the collective approach is the ambiguity it may create with respect to the transfer of policy sovereignty. If the authority of the union-wide agency is seen as contingent on unresolved political decisions by national governments, the agency may find itself either unable or unwilling to constrain national policies during the transition. The system may then evolve into a *de facto* delegated anchor or a managed float system, but with substantial policy uncertainty in the meantime and with damage to the credibility of the union-wide central bank.

A second disadvantage of the collective anchor system, when it is accompanied by strong commitments to an internal grid, is that it builds in a subtle but potentially dangerous ambiguity in nominal anchors. With n – 1 exchange rates tied down or substantially limited by the grid, there is room, strictly speaking, for only one nominal anchor for the union-wide system. The delegated anchor system supplies this efficiently, by allowing one country to operate a domestic anchor. The collective anchor system might proceed similarly, for example by choosing a union-wide monetary aggregate and allocating the corresponding target paths for country-level aggregates. But at the operational level, individual central banks would then be dealing with two anchors – intra-union exchange rates, on the one hand, and monetary aggregates on the other. Moreover, while theory suggests that sterilized intervention may be

sufficient to maintain the intra-union grid in such a system, the burden of intervention would have to be shared in some explicit way. It is not obvious how to structure the relationship between the center and the national central banks so as to avoid questions about the credibility of either the exchange rate commitments or the monetary programs. With open capital accounts, these concerns could place exchange rate commitments under stress, leading to volatility in exchange rate expectations and possibly to speculative attacks that impose costs during the transition phase and undermine the credibility of union-wide policy.

5. The conversion phase

The defining steps in the consummation of a monetary union are the transfer of monetary policy to a supra-national authority and the conversion of multiple national currencies to a single currency. We focus here on the process of currency conversion, leaving issues of institutional transition to Section 6.

5.1. Establishing a new East African currency

Despite the current travails of the Euro zone, the successful replacement of the individual currencies of its eleven founding members with the euro on 1 January 1999 was acclaimed in all quarters and offers a valuable template for managing the final stages of the transition to monetary union in East Africa. For reasons we discuss below, the conversion phase should be short, ideally around two quarters. It should commence with a major, union-wide announcement of:

1 – A date for the creation of full monetary union.

2 – A commitment by the Partner States to the irrevocable conversion of their national currencies into a new East African currency on that date.

3 – A set of (final, possibly revised) basket weights for the East African Currency Unit (EACU).

4 – A set of irrevocable central parities between national currencies and the EACU at which conversion to the new currency will occur.

Explicit exchange rate commitments will therefore feature prominently during the conversion phase, regardless of the presence or absence of such commitments during the convergence phase. Partner States will establish a tight internal grid – a set of intra-union cross-rates – by committing to keep their currencies within very narrow bands of a set of central parities against the EACU. The EACU, computed as a weighted basket of the Partner State exchange rates *vis à vis* an external reference currency (most likely the US dollar), will serve as a unit of account between the Partner States during the conversion phase, and may be established for this purpose considerably earlier, during the convergence phase. At the consummation of union, the EACU will convert at an exchange rate of 1:1 with the new (still to be named) East African currency. The relation of national currencies to the EACU will therefore determine

the conversion rates at which basis Partner States' currencies will be fixed against the new currency. These conversion rates will determine the purchasing power of the new currency in each jurisdiction; it is therefore important that the basis for the computation of conversion parities is transparent and widely understood and that the established rates do not lock-in significant real exchange rate misalignment at the inception of the Union.

Notice that in item 4 above, the internal grid that is implied by any set of conversion rates is fully specified once any $n-1$ independent restrictions on intra-union exchange rates have been determined. Specifying any single Partner State's central parities against each of its 4 EAC partners, for example, would determine all internal cross-rates as well as the implied rate between each currency and any given EACU. This means that unless an external grid is used for the conversion phase, the process of specifying and committing to conversion rates will not tie down the relation of any single Partner State's currency, or that of the EACU itself, to global currencies. As in Option 4 for the conversion phase, this task is left to domestic inflation anchors.

At the termination of the conversion phase, operational authority and relevant sovereignty will formally transfer from national central banks (and the East African Monetary Institute) to the East African Central Bank (EACB). The EACB will necessarily acquire *de facto* sovereignty in the monetary policy domain during the conversion phase, however, coordinating the process of conversion at the agreed parities and overseeing the implementation of a collective inflation anchor for the EACU.[14] The inherent ambiguity of this dual-anchor system – which requires the simultaneous commitment to a common nominal anchor and a very tight internal exchange rate grid – is the main reason why the conversion phase should be as short as possible.

Following the European example, the new currency should initially be used for non-physical transactions (i.e. electronic / interbank transfers etc), with national-currency notes and coin continuing to circulate *as legal tender* within national jurisdictions at a retail level (at their fixed parities to the new currency) for a period of time prior to the introduction of new notes and coin. From the moment of union, all public-sector transactions, interbank payment system clearing activities, and new debt issues and rollovers would be obliged to be denominated in the new currency; bank accounts held in national currencies would be reported, in parallel, in the new currency unit. In the Euro zone, new notes and coin were introduced in January 2002, three years after the creation of the Euro, but this interval could be shortened. Reflecting the sophistication of the member economies, the changeover of notes and coin in the Euro zone lasted little more than two months although all national central banks stood ready to accept old currencies for a significant period of time thereafter (with most central banks announcing willingness to accept old currencies in perpetuity[15]). The changeover period for notes and coin in East

[14] The actual transfer of sovereignty could follow a similar path. In the Euro zone, for example, the enabling legislation creating the ECB in May 1998 (8 months ahead of union) simultaneously established the Eurosystem (as the sovereign network of national central banks and the ECB) though which the ECB acquired its current operational authority in January 1999.

[15] The purpose of this commitment is to stand ready to facilitate the smooth and progressive exchange of notes and coin in a manner that underpins confidence in the new currency.

Africa may take somewhat longer than in the Euro zone and will certainly need to be timed to synchronize with the seasonality of economic activity in the region. Whether the period to full implementation could be shortened will depend on a host of practical considerations on the cost and complexity of switching that are beyond the scope of this report. But if the Euro zone blueprint is followed the duration from formal union to the sole circulation of the new currency at the retail level could be of the order of 2-3 years.

During the changeover phase of monetary union 'dual pricing', in new and old local currency values, will be necessary and desirable for wholesale and retail goods and services (including for all invoicing, wages and salary notification, bank statements and so forth). These changeover costs will be unavoidable but necessary to build confidence in the new currency and providing some protection against opportunistic price adjustment.[16]

5.2. Constructing an East African Currency Unit

Conversion parities can be defined relative to an East African Currency Unit (EACU) which is defined as a weighted average basket of the partner currencies. By committing to stay within a narrow band of the EACU, each country in effect commits to keep its own exchange rate movements, relative to the US dollar or any other currency, close to those of its partners. The EACU basket will combine b_j units of each of the $j = 1, \ldots, 5$ currencies of the EAC, where number of units will be chosen to reflect the relative economic sizes of the partners and to generate a given market value of the basket against some reference currency in some reference period. For the EAC, there are three natural reference currencies. The US dollar is the main intervention currency of all five central banks and the main rate tracked by market participants. The euro is the currency of the Euro zone, the community's largest trading partner by far. The SDR has global status as a reserve currency. In practice, however, all five central banks treat the US dollar as the *de facto* reference currency. Here we provide an illustrative computation using the US dollar, using December 31, 2010. To measure relative economic size, we use the US dollar value of GDP at official exchange rates in 2010.

Table 2 shows the GDP weights of EAC countries in 2010 along with their end-of-year nominal exchange rates against the US dollar. If the EACU is to equal one US dollar on December 31st, the GDP weights w_{j0} give the fraction of that dollar that should be contributed by each currency. The number of units of currency *j* in the basket is therefore given by

[16] There was a widespread perception on the part of consumers in the Euro zone that retailers took advantage of the currency changeover to raise prices. Survey-based measures of inflation – reflecting subject perceptions – diverged sharply from official measures throughout the first quarter of 2002 raising concerns about the quality and credibility of official measures, including the newly-introduced Harmonized Index of Consumer Prices. Subsequent analysis suggests that on average consumer prices did not rise more than official statistics indicated, suggesting that perceptions were affected by large 'rounding up' adjustments to some psychologically important low-priced and frequently-purchased items. The same phenomenon occurred with the decimalization of currency in the United Kingdom in 1971.

$$b_j = w_{j0} \cdot E_{j0}, \quad (1)$$

Table 2 *A sample East African Currency Unit (EACU)*

Country	Baseline basket weights (share of EAC GDP, 2010) (w_{j0}) [1]	Exchange rate per US dollar Dec 31, 2010 (E_{j0}) [2]	Number of units in basket (b_j) [1]*[2]/100 [3]	Basket weight as of Oct 31, 2011 (w_{jt}) [4]	Deviation from EACU, October 31, 2011 (positive => excess depreciation) [5]
Burundi	2.05	1232.50	25.22	2.26	-9.55%
Kenya	39.90	80.75	32.33	37.47	6.49%
Rwanda	7.15	594.45	42.50	8.19	-12.74%
Tanzania	29.29	1455.15	426.23	29.76	-1.55%
Uganda	21.61	2308.30	498.84	22.32	-3.18%

Source: IMF, *International Financial Statistics*, and authors' calculations.

where E_{j0} is the bilateral exchange rate against the dollar for EAC country *j* at the end of 2010. As exchange rates evolve over time, the market value of the EACU will evolve, as will the weights of its constituent currencies in the basket. At time *t*, one EACU will purchase $\sum_{j=1}^{5} b_j/E_{jt}$ dollars, implying an exchange rate, in EACU per US dollar, of

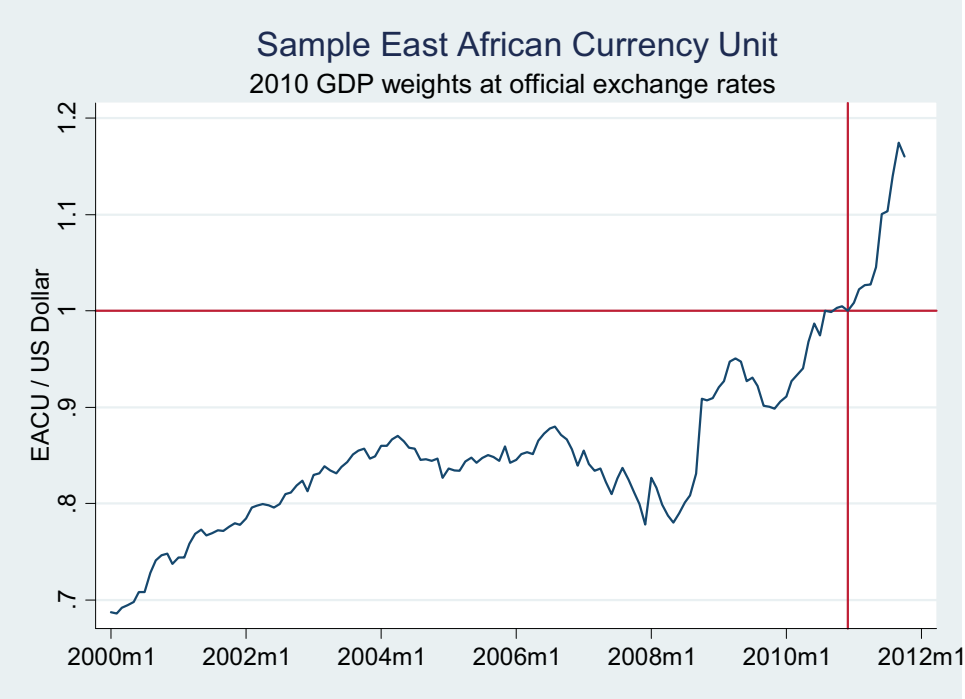
$$E_t = \left[\sum_{j=1}^{5}\left(b_j/E_{jt}\right)\right]^{-1} \quad (2)$$

The basket weight of the i^{th} currency will therefore become

$$w_{jt} = \left(b_j/E_{jt}\right) \cdot E_t \quad (3)$$

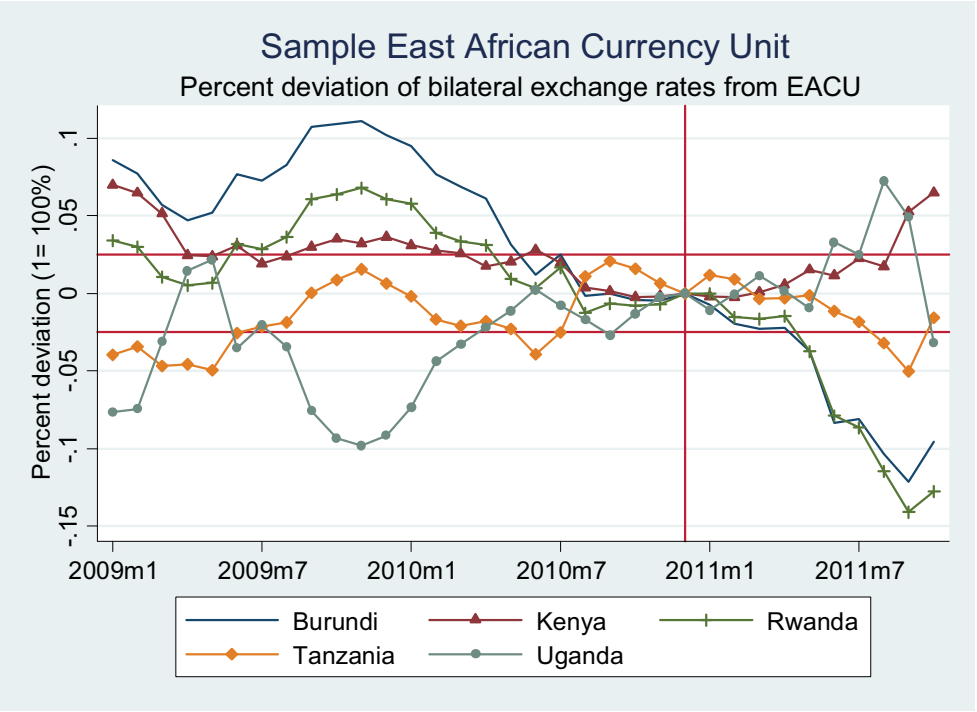
In the final two columns of Table 2 we show the basket weights and the percentage deviation of each Partner State currency from the EACU as of October 31, 2011. Figure 2 shows the exchange rate of this sample EACU against the US dollar for the period from 2001 and Figure 3 plots the percentage deviation of each Partner State's exchange rate from the EACU for the period from 2009 where the horizontal lines indicate the ± 2.5% band around the EACU. The sharp depreciation of the Kenyan and Ugandan Shillings, and to a lesser extent the Tanzanian Shilling, against the US dollar in the second and third quarter of 2011 was not shared by the Burundi or Rwanda Francs so that cross-rates moved significantly outside the 2.5% band.

Figure 2 *Exchange rate of a sample EACU (EACU/USD = 1 on December 31, 2010)*



Source: IMF, *International Financial Statistics*, and authors' calculations.

Figure 3 *Internal Grid: deviation of Partner States exchange rates from EACU 2009-2011*



Source: IMF, *International Financial Statistics*, and authors' calculations.

5.3. Establishing conversion parities

When Partner States enter the conversion phase, they permanently forego the use of intra-union exchange rates as a market-clearing price or a policy instrument. In the literature on monetary unions, this sacrifice is potentially costly because nominal exchange rates may have a role to play in two types of macroeconomic adjustment. The first is the elimination of exchange-rate misalignments.[17] Unless wages and prices in Partner States are determined in continuously-clearing competitive markets, short-run rigidities can leave real exchange rates far from equilibrium when a macroeconomic shock alters the economy's equilibrium real exchange rate.[18] The second is reconciling different fiscal needs for devaluation, associated either with different medium-term preferences for inflationary finance or with short-run fiscal solvency pressures that favor a *de-facto* default on non-indexed domestic-currency liabilities of the public sector.

The second of these concerns is well illustrated by the plight of Greece in the Euro zone (and, by implication, that of its richer partners). As we have already emphasized, the dangers of fiscal divergence point to the importance for EAC countries not merely of convergence criteria for inflation and fiscal deficits, but also of mechanisms to limit post-union fiscal divergences and ensure debt sustainability across Partner States.

The costs of exchange-rate misalignment are of central interest to us in this section because they play a potentially important role at the point of entry into union. If the conversion rates imply divergent degrees of initial real exchange rate misalignment across the union, Partner States with relatively strong currencies at conversion will be high-cost economies by global standards, and hence at a competitive disadvantage, and those with relatively weak currencies will be low-cost economies enjoying competitive advantage. These differences should erode over time, principally through differential wage and price adjustments, sped along by cross-border labor migration in search of higher wages. But there may be substantial macroeconomic strains in the interim, including impacts on investment patterns and fiscal performance. The high-cost economies will tend to have lagging exports and employment, while the low-cost economies may find themselves to be differentially strong exporters and recipients of foreign direct investment inflows. Depending on each country's tax structure, these differentials will also imply potentially different fiscal performances.

[17] The literature on optimal currency areas (see de Grauwe 2009) emphasizes that the cost of sacrificing the exchange rate instrument depends on the degree to which shocks tend to be symmetric or asymmetric across countries. Symmetric shocks may generate union-wide exchange-rate misalignments, but since the degree of misalignment is similar across countries the required adjustment can be accomplished through movements in the union currency. Asymmetric shocks, in contrast, create divergences in the degree of misalignment across the union – divergences that can no longer be addressed through movements in intra-union exchange rates. The cost of moving to a common currency therefore depends on the union's exposure to asymmetric shocks and on the viability of alternative adjustment mechanisms, including wage/price flexibility, cross-border labor mobility, and union-wide fiscal policies.

[18] See Hinkle and Montiel (1999) for a survey of theory and evidence on real exchange rate misalignment.

Conversion parities should be chosen, then, with a view to minimizing the need for differential real exchange rate adjustments within the union in the immediate post-union period. Below we discuss alternative methodologies for making this choice. Before turning to this, however, we ask a simple question, as a way of gauging the urgency of these calculations: is it possible that nominal rigidities are not a serious constraint on real exchange rate adjustment in the EAC economies? If the large informal sectors and relatively uncomplicated supply chains that are characteristic of these economies mean that price rigidities are largely absent, then the likelihood of extended real exchange rate misalignments – and the urgency of setting appropriate conversion parities – may be relatively limited.

In a background note we provide some preliminary evidence on this question, by comparing patterns of monthly real-exchange-rate adjustment between the EAC and a set of 19 OECD and emerging-market countries operating flexible exchange rate regimes.[19] Our point estimates imply somewhat greater price flexibility in the EAC and the emerging-market economies than in the industrial countries; in the latter, in fact, we cannot reject that prices play no role at all in accomplishing real exchange rate adjustment. But relative price adjustment speeds remain low even in the EAC and emerging-market groups – roughly 5 percent per month on average – and there is no tendency for faster adjustment in the EAC than in the richer emerging-market group. Within the EAC, prices play a somewhat larger role in Burundi and Rwanda than in the three larger economies, but these differences are not statistically significant.

There is some evidence, therefore, of greater price flexibility among the EAC countries than among industrial countries, but not enough to eliminate concerns about slow correction of initial misalignments. Moreover the economic benefits of a relatively weak currency are known to the participants *ex ante*. This reality implies that policymakers in each economy may have an incentive to enter the union at a relatively weak conversion rate against the union currency. This underscores the need for choosing appropriate central parities on entry into the conversion phase, and also – particularly if a managed float system is chosen for the earlier, convergence phase – for adherence to convergence criteria for inflation throughout the transition.

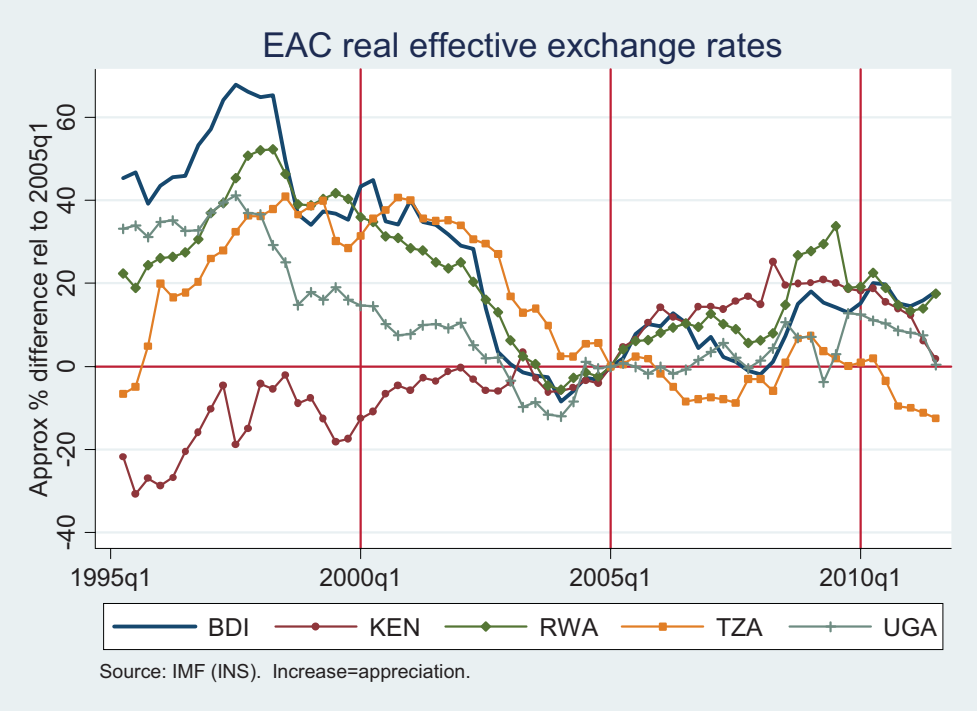
5.3.1. Real exchange rates in the EAC

Figure 4 shows partner-trade-weighted quarterly real exchange rates of the EAC countries from the first quarter of 1995 to the third quarter of 2011 (an increase denotes a real appreciation). The underlying monthly data are index numbers, and cannot be compared across countries; in the graph, we have

[19] See Adam, Kombe and O'Connell (2012) "Price and Exchange Rate Flexibility in the EAC: Evidence from Short-Run Real Exchange Rate Movements" February. For each country, we use an HP filter to remove the nonstationary component of the real exchange rate. We interpret the remaining, stationary component as a rough proxy for the degree of short-run misalignment relative to the long-run equilibrium exchange rate. Using the lagged value of this proxy as an explanatory variable, we estimate separate error-correction equations for the two components of the observed change in the real exchange rate: the rate of nominal exchange rate depreciation against trading partners, and the differential between home and trading-partner inflation. In each case we ask how that component of the overall change in the real exchange rate responds to the lagged degree of misalignment.

normalized them to 1 in the first quarter of 2005.[20] Vertical differences are approximately equal to percentage changes relative to 2005q1.

Figure 4 *Real exchange rates in the EAC, 1995q1-2011q3*



Note: The Figure shows the log of a 2005q1=1 index of the trade-weighted real effective exchange rate. Source: IMF, INS database.

Relative PPP fails to hold in EAC countries, in the sense that real exchange rates show no tendency to return to fixed long-run averages.[21] Low-frequency movements nonetheless show some similarities over time, suggesting that the countries of the EAC face some important common shocks. There is some evidence in Figure 4 that real exchange rates have been more stable in the community since the mid-2000s, both over time and relative to each other.

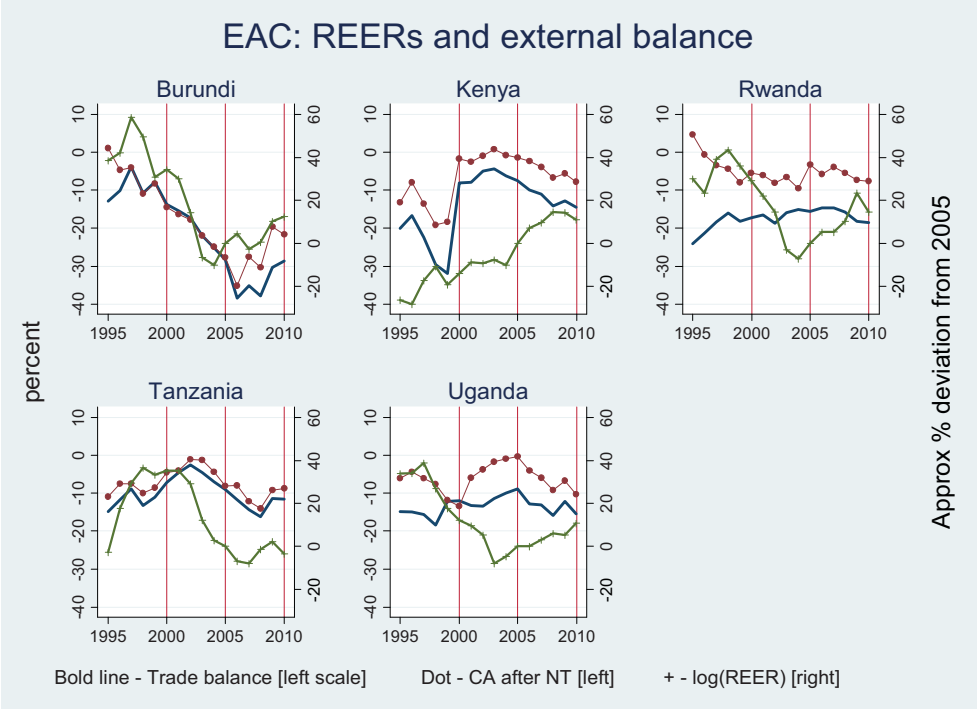
Following a period of general real appreciation between 1995 and 1998, all five currencies depreciate in real terms following the Asian financial crisis of 1997/98. They then show a period of stability before depreciating again starting in 2002, following the September 11 attacks in the USA and in the run-up to the invasion of Iraq. The period from 2004 to 2008 is one of cumulative real appreciation in most countries, despite the inexorable rise in global oil prices that started in early 2003; with the exception of Kenya, the community experiences a relatively sharp real appreciation during 2007/08. This appreciation reverses itself, however, following the global financial crisis of late 2008. The shift to real

[20] See the Appendix for a measure of relative prices that is internationally comparable – based on comparing national prices (at official exchange rates) with international reference prices for the same basket of goods and services.
[21] We cannot reject that the series in Figure 4 all contain unit roots.

depreciation in 2008/09 occurs earlier for the three large economies of the EAC than for Burundi and Rwanda; this may be consistent with the greater export dependence and sensitivity to private capital flows of the larger economies.

Figure 5 shows the real exchange rate (right scale) along with two measures of external balance for the EAC countries: the trade balance in goods and services and the overall current account balance after grants (right scale). The latter variable is equal to the country's overall net capital outflow (inclusive of reserve accumulation, extraordinary financing, and use of IMF credit). Standard macroeconomic theory predicts a two-way negative correlation between the real exchange rate and the trade balance: a real appreciation reduces the relative price of traded goods, worsening the trade balance, while the external-financing counterpart of a larger trade deficit supports higher overall spending, appreciating the real exchange rate. With the exception of Uganda, however, this correlation appears to be overwhelmed by other factors. In Burundi and Tanzania in particular, the low-frequency bivariate correlation between the real exchange rate and the external balance looks sharply positive, rather than negative: long-run improvements in the external balances correspond to periods of real appreciation rather than depreciation.

Figure 5 *Real exchange rates and external balance 1995-2010*



Source: IMF, INS database and *International Financial Statistics*

5.3.2. Choosing conversion parities

Two main questions have to be answered in the course of choosing conversion parities. First, do existing spot rates form an adequate basis for conversion? If so, they can be locked in. Second, if

adjustments to intra-union parities are required, how large and in what directions? A confident answer to these questions requires an empirical apparatus for assessing the degree of real exchange rate misalignment on a country-by-country basis. In an internal grid, it is only *relative* degrees of misalignment that matter, because adjustments to internal parities leave the average rate of misalignment against global currencies unchanged (and, in any case, amenable to movements in the EACU against global currencies). Nonetheless, given the relatively modest trade links between EAC countries (see Appendix 1), the analysis of relative misalignment will itself require country-by-country assessments of multilateral real exchange rates are consistent with international competitiveness and macroeconomic balance in the medium term.

The IMF uses three complementary approaches in the exchange rate assessments it conducts in advanced and emerging-market economies.[22] Two are based on identifying a current account 'norm' – an appropriate medium-term level of the current account for the country – and comparing this with the 'underlying' current account, defined as the current account that is projected to prevail at the current real exchange rate once price-adjustment lags have worked out and the country and its trading partners are at a neutral stage in their respective business cycles (defined as GDP gaps of zero). Using an assumed elasticity of the underlying current account with respect to the real exchange rate, the degree of misalignment is calculated as the real exchange rate change required to close the gap between the underlying current account and the norm. In the *macroeconomic balance* approach, the norm is defined in terms of the determinants of the domestic saving-investment balance. In the *current account sustainability* approach, it is defined as the current account that would stabilize the external debt to GDP ratio at its current level, given medium-term projections of inflation rates, borrowing terms, and real growth rates.

In the third, *fundamental equilibrium exchange rate* or 'FEER' approach, the real exchange rate is modeled econometrically along with a set of variables – the 'fundamentals', like the terms of trade, government spending, and the productivity gap with trading partners – that alter the economy's internal and external balance position. The equilibrium rate is defined as the rate consistent with projected values for the fundamentals. In IMF practice, the elasticities of the real exchange rate with respect to the fundamentals can be drawn from global or regional panel regressions or, where the data allow, from the estimation of an equilibrium relationship at the country level.

Given the limitations of any single approach to assessing misalignment, a battery of complementary approaches should be used. The IMF's Regional Economic Outlook for Sub-Saharan Africa in May 2011 reports a careful recent application of the 3-pronged approach described above to the EAC countries, with FEER relationships estimated at the individual-country level.[23] In our view this approach – complemented by the more detailed country-level FEER-modeling efforts already underway in the community – provides a useful model for the process that should be used to inform the choice of

[22] See Lee et al. (2008). See Adam and O'Connell (2012) for a background note on the application of these methods to low-income countries.

[23] Figure 3.14, page 64 in IMF (2011) shows 3-year moving averages of misalignment for the EAC countries, based on a forthcoming IMF Working Paper by M. Opoku-Afari and S. Dixit.

conversion rates in the EAC. Misalignments should be monitored on a continuing basis during the convergence phase, so that the requisite empirical exercises are in place when the Partner States decide to enter the conversion phase. Conversion rates should then differ from recent spot rates, in our view, only if the estimated degrees of relative misalignment are large – above 15 percent, for example, on a bilateral basis.

5.4. Risks at conversion

An EACU of the form outlined above should be computed, on an agreed basis, throughout the convergence period. It is possible but not necessary to re-base the underlying GDP weights but it is essential that the weighting used during the final conversion period secures the full agreement of the Partner States.[24] The EACU presented here weighs countries according to their relative GDP in 2010, as measured and reported by the World Bank. This scheme has the virtue of transparency and verifiability, but alternative bases for weighting are also feasible. For example, Partner States may agree to use an average of GDP shares over, say, the last three years, or to base weights according to countries' contributions to total trade or extra-union trade.

The final underlying weights for the EACU, $b_j = w_{j0} \cdot E_{j0}$, should be based on recent GDP or trade data and must be agreed by the beginning of the conversion phase at the latest. The internal grid of cross-rates around the EACU will be established at this time with the final conversion rates with the new East Africa currency defined simply as the central parities of this grid. For example, in the case of the Euro, the central parities were established in May 1998 and the final conversion rates were agreed in advance to correspond to the spot rates between the national currencies and the European Currency Unit (ECU) that would prevail 30 minutes before the close of markets on 31 December 1998, approximately 12 hours prior to monetary union: national central banks were, however, required to intervene to ensure these closing spot rates were within the (very) tight band of the grid's central parities.[25] It is the credibility of this commitment that will help to deliver a smooth path towards the final conversion parities and avoid the emergence of speculative attacks on individual currencies during this closing phase of the transition to monetary union.

The exact arrangements for conversion will need to be determined and agreed prior to the beginning of the conversion phase. In addition, close and highly public cooperation between Partner State central banks will be required, supported by the EAMI. In the case of EMU (and indeed during the entire era of the Exchange Rate Mechanism), participating central banks stood ready to buy and sell each other's

[24] The EACU as described above is a 'fixed units / variable weights' basket. The number of currency units is fixed by the underlying GDP shares (column [1] of Table 1) and the exchange rates prevailing at the baseline date. The weights of different currencies in the basket, however, evolve to reflect the relative strength of the individual currencies. Thus over time, for a fixed set of currency units, the weight of currencies that strengthen relative to others in the basket will rise and vice versa. It is therefore possible to re-set the GDP weights underpinning the basket, while keeping unchanged the value of the EACU (internally or externally) by making an offsetting adjustment to the number of each currency unit in the basket. Throughout the history of the ECU, the weights were adjusted only twice, once in 1984 and again in 1989.

[25] ECB (2010)

currencies, either directly or through credit lines or swap arrangements. The purpose was to signal a willingness to intervene to an unlimited degree in order to ensure that market rates converged on the pre-announced rates. As de Grauwe (2009) noted, this commitment proved sufficient to anchor market expectations on the conversion parities, so that very little intervention was required.

This discussion highlights the balance of risks in establishing the duration of the conversion phase. A longer conversion phase increases the risk that shocks to exchange rate fundamentals will undermine the viability of the conversion parities, while a shorter phase makes it more difficult to establish the transparency and coherence required to underpin a credible commitment to the conversion parities.

5.5. Exchange rate policy during the conversion phase

Nominal and hence real exchange rate misalignment will present a risk throughout the conversion phase, although to the extent that this phase will only commence once a sufficient degree of macroeconomic convergence has been achieved these risks should be substantially mitigated. Nonetheless, residual risks arise from Partner States' incentives to lock-in gains from competitive devaluation as unification approaches and from unanticipated asymmetric shocks to Partner States' equilibrium real exchange rates once the internal grid governing nominal rates has been established. The former emphasizes the importance of anchoring the internal grid and the latter underlines the need for a short conversion phase.

The arrangement we are recommending for the conversion phase is similar in structure to Options 4 and 5 in our earlier discussion, both of which combined a grid of intra-union exchange rates with a domestically-oriented anchor based on inflation or money growth rates. Exchange-rate commitments during the conversion phase would be tighter in two key respects, however, than those appropriate for a potentially lengthy convergence period. First, the central parities would be irrevocable: there would be no escape clause allowing a realignment of the grid during the conversion period. Second, the fluctuation bands would be narrow (or narrowing), allowing only minor fluctuations around the central parities.

Like Options 4 and 5, this arrangement we are recommending is potentially subject to dual-anchor ambiguities. Partner States will pursue a (common) inflation target at the country level while simultaneously maintaining a commitment to intra-union exchange-rate targets. Options 4 and 5 differed in how the ambiguities inherent in this mandate were to be resolved: informally, as in Option 4, or via formal cooperation mediated by a supra-national institution (the EAMI), as in Option 5. Once the conversion phase has been entered, however, the informal approach is ill-advised. The EAMI/EACB will have a critical role to play in supporting and coordinating national policies during the conversion phase. Assuming that a sustained degree of macroeconomic convergence has been achieved by the time the conversion phase commences, dual-anchor ambiguities can be resolved in favour of exchange rate commitments, as long as the conversion phase is short. Partner State central banks will therefore be obliged to intervene to maintain their nominal exchange rates within the tight grid, with appropriate

assistance – possibly including a mechanism for coordinated intervention – from the EAMI/EACB. We discuss the requisite institutional capacity-building in the next section.

6. Institutional capacity-building

The purpose of the convergence period is to allow the macroeconomic and institutional prerequisites for a successful union to be established. Failure to achieve them will make the transition more difficult and risky, and the union itself less robust, regardless of the common transitional exchange rate policy adopted. In this section we discuss institutional prerequisites that bear directly or indirectly on exchange rate management during the transition. Our working assumption is that the East African Monetary Institute (EAMI), as the precursor to an East African Central Bank, will be the locus for community-wide functions related to exchange rate management.

The task of assessing real exchange rate misalignment and determining appropriate conversion parities, which we discussed above, will naturally fall to the EAMI. At least as critical, however, is a set of initiatives designed to reduce the Partner States' exposure to destabilizing capital flows and exchange rate volatility during the transition and after union is established. Along with promoting the harmonization of inter-bank foreign exchange markets, these include:

- Establishing appropriate reserve-pooling mechanisms.
- Building the capacity for coordinated intervention during the conversion phase.
- Developing community-wide prudential regulations on capital flows and the financial sector.

We discuss the first two of these in section 6.1 below. The third – the case for community-wide prudential regulations – is driven by the proliferation of cross-border risks that accompanies monetary union. These are partly the natural consequence of increased financial flows both within the union and vis-à-vis external partners. But union may also create moral hazards in the regulatory realm, where the prospect of a bailout by the union-wide central bank undermines the vigilance of national regulatory authorities. Discussions regarding the harmonization of capital controls should, in our view, include the consideration of modest tax-like controls on short-term debt-creating flows, with a view to limiting the community's exposure to financial reversals during the conversion phase.

The EAMI will also be engaged in building the technical capacity for union-wide monetary and exchange rate policy. Particularly in the absence of exchange-rate commitments during the convergence phase, this process should be viewed as an indispensable opportunity to enhance cooperation, identify potentially damaging economic divergences among the Partner States, and put appropriate mechanisms in place before union is established. For this reason we place particular importance on the development of a shadow EAC-wide financial programming exercise by the EAMI, as a framework for assessing the

union-wide implications of national budgetary policies, balance of payments projections, and monetary policy targets. Similar logic favors the development of a collective debt sustainability exercise.

6.1. Reserve pooling and coordinated intervention

We have argued that the Partner States should commit to an internal exchange rate grid during the conversion phase. This can be done by announcing the central parities and fluctuation bands, and then being prepared to intervene to prevent a breaching of the bands. Here we discuss the institutional requirements for carrying this out successfully, within the context of a managed float against global currencies.

To fix ideas, we consider an example in which two countries – A and B – are planning to form a monetary union.[26] The external exchange rates of these two countries are E_{At} and E_{Bt}, in local currency units per US dollar. The partners create a GDP-weighted currency basket containing $\theta_A E_{A0}$ units of country A's currency and $(1-\theta_A)E_{B0}$ units of country B's currency, where θ_A is the share of country A in total (A + B) GDP; by construction, the basket has a US dollar value of 1 in the base period. The external exchange rate of the basket in period *t* is $E_{Ut} = [\theta_A\, E_{A0}/E_{At} + (1-\theta)\, E_{B0}/E_{Bt}]^{-1}$, where 'U' denotes the union's currency unit.

In the period before union, the US-dollar exchange rates of the two national currencies are determined in the interbank markets of the two countries. If interbank or retail transactions can take place between the two currencies, the possibility of arbitrage should keep the market exchange rate in such transactions within transactions-cost margins of the rate implied by the two interbank rates. The internal exchange rate between the two currencies is therefore $E_{ABt} = E_{At}/E_{Bt}$.

As the two partners enter the conversion phase, they specify a central parity $\bar{E}_{AB}$ for the internal exchange rate and commit to keeping the actual bilateral rate, E_{ABt}, within given fluctuation bands around this parity. They underscore this commitment by standing ready to exchange home currency for the partner-country's currency with any private agent, at buy and sell rates that are given by the fluctuation bands. Country A's central bank therefore stands ready to buy country B's currency in unlimited amounts for $\bar{E}_{AB} - b$, or sell it in unlimited amounts for $\bar{E}_{AB} + b$; country B's central bank stands ready to buy country A's currency at the rate $\bar{E}_{AB} + b$ or sell it at the rate $\bar{E}_{AB} - b$.[27] This arrangement might be supported, as in the ERM, by an unlimited swap agreement that allows each country to borrow the other's currency freely for intervention purposes.

Suppose now that pressure begins to emerge on the external value of country A's currency, which begins to depreciate against the US dollar. If country B experiences the same pressures, and the two countries allow the same degree of external depreciation, there will be no change in the internal market

[26] The logic of this example extends to the case in which B is a group of countries.

[27] Thus using one unit of country A's currency to buy country B's currency from central bank A and sell it to central bank B yields $(\bar{E}_{AB} - b)/(\bar{E}_{AB} + b) < 1$ units of country A's currency, a loss.

rate between the two currencies. If these pressures are specific to country A, however, the internal rate E_{ABt} will begin to depreciate. Once this rate exceeds $\bar{E}_{AB} + b$, banks and other private traders can profitably arbitrage between the two internal rates – the one posted at the central banks and the one implied by transacting in dollars in the two countries. To complete the arbitrage, a bank would sell country A's currency to either of the central banks for country B's currency, sell the resulting units of B's currency for dollars in country B's interbank market, and then convert these dollars back into country A's currency in country A's interbank market. These transactions should tend to weaken B's external exchange rate and strengthen A's, thereby keeping the internal rate at the boundary of the band. Both central banks will find themselves accumulating country A's currency and losing country B's currency. Country A may need to support its band by receiving a local-currency swap from country B, with the accompanying liability possibly denominated in the union basket.

If the macroeconomic situation that is driving E_{ABt} past $\bar{E}_{AB} + b$ is not resolved, country A faces an unsustainable increase in its liabilities to country B. One or both of the partner countries must make a monetary policy adjustment sufficient to bring E_{ABt} back inside the band; or the band itself must be adjusted, through a change in the central parity and/or the width b. If the internal grid were to operate over an extended period, as in the European case, the central parities would in principle have to be adjustable, subject to a mechanism for determining when an adjustment was needed and of what size. The bands would also be adjustable; they were widened for Italy, for example, when speculative pressures drove the lira outside of the 2.5 percent bands. The possibility of an adjustment, however, greatly increases the system's exposure to a speculative attack; as we have stressed above, this is an important weakness of the internal grid system in the context of an open capital account. For the final conversion phase, therefore, where the credibility of the central parities is of overriding importance, no adjustment can be contemplated. The internal grid must be defended through some combination of monetary policy changes and intervention. In principle, intervention can be designed either to strengthen country A's external exchange rate or – through purchases of dollar reserves by country B – to weaken country B's external exchange rate relative to A's. Given the need for rapid adjustment, however, and the danger of allowing concerns to emerge about credibility, the more plausible solution by far is intervention in support of the external value of country A's currency.

It follows from this analysis that while an internal grid does not formally anchor the external value of Partner State currencies, delivering such a commitment successfully in the EAC will require the operation, during the conversion phase, of the near-equivalent of an external grid system. This in turn points to the critical importance of reserve adequacy, both on an individual-country basis and, possibly, via a reserve-pooling mechanism that goes beyond national-currency swaps to involve shared access to union-wide hard-currency reserves.

Appendix Table A1.5 documents the transformation of international liquidity in recent years in the EAC. Reserve levels have improved steadily across the community. They are close to the convergence criterion of 6 months of imports and well above international benchmarks relative to recorded short-term debt. Exchange-market pressures have nonetheless been relatively severe in the three large countries of the community over the past six months. Reserve levels have been protected by the

willingness of Kenya, Tanzania and Uganda to tolerate sharp nominal depreciation and, in October 2011, to implement a coordinated tightening of monetary policy. The associated movements in external exchange rates have implied large fluctuations in intra-union exchange rates.

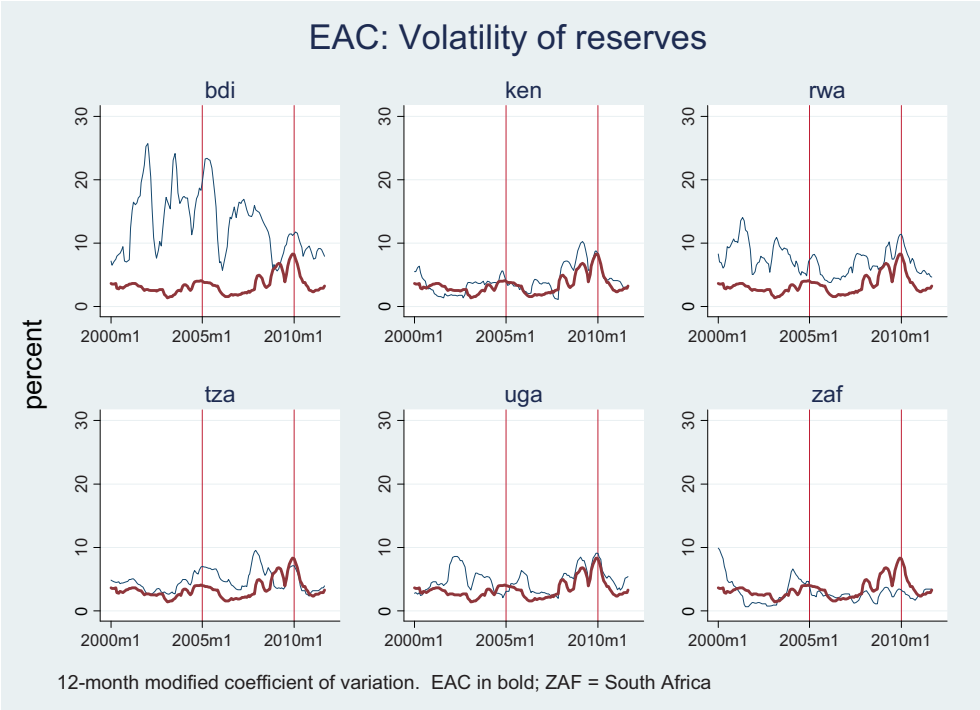
The central principle of a hard-currency reserve pool is mutual insurance. Thus, even if each member is obliged to maintain a fixed long-run average contribution to the pool, the fact that shocks to reserves are not perfectly correlated across countries means that the volatility of the overall pool is smaller than the average volatility of shocks to individual members. Figure 6 illustrates the potential for mutual insurance among the EAC countries. We compare the time-varying volatility of reserves for individual countries with the same measure for EAC-wide reserves. For the EAC as a whole, the volatility of reserves is similar to that of South Africa (which is 2/3 larger by GDP). This tends to be considerably lower than the volatility for individual Partner States. The differences are considerably larger for the smaller countries, reflecting both their size and their much smaller degree of exchange rate flexibility. But even for the larger countries, temporary access to a community-wide pool could substantially enhance the scope for short-term intervention.

Insurance schemes are subject to moral hazard, and this concern is particularly strong in the case of a hard-currency reserve pool. The danger is that countries will adopt excessively expansionary monetary policies during the conversion phase, knowing that the costs of exchange rate weakness will be shared with other members. For this reason any hard-currency reserve pool should, in our view, have a graduated interest cost structure that allows nearly-costless drawing in limited amounts but discourages over-use. In any case, of course, the importance of transparency, credibility and speed in handling exchange market pressures during the conversion phase reinforces our earlier argument in favor of the EAMI's role as a forum for information sharing and coordination across the Partner State central banks.

7. Risks of a premature union

A move to monetary union in EAC will enhance economic integration among the Partner States and may improve the conduct of monetary policy by insulating it from political pressures operating in individual countries. The process of integration depends at least as strongly, however, on continued progress in constructing a unified regional market, including the removal of lingering barriers to cross-border trade, financial transactions, and the movement of persons. And while transferring monetary policy to a supra-national authority may improve its overall conduct, the bar for this is high in the EAC, where national central banks have been largely successful – after securing adequate domestic fiscal control – at controlling inflation, managing credit conditions, and avoiding excessive volatility in exchange rates. The economic costs of delaying a move to union may therefore be mild. The risks associated with moving prematurely, in contrast, are potentially large. In this section we review briefly these risks and the appropriate responses during the convergence phase.

Figure 6 *Volatility of international reserves in the EAC*



Source: IMF, *International Financial Statistics*

7.1. Fiscal spillovers

Union members adopt a common exchange rate, a pooling commitment for international reserves, and a shared interest rate structure. The costs of fiscal excess, which normally operate through a country's external balance and/or cost of borrowing, are therefore borne in part by the union as a whole, and are diluted from a national perspective. Moving to union therefore risks a loss of fiscal discipline in individual countries or in the union as a whole, with damaging implications for the credibility and operation of union-wide monetary policy.

The nature of fiscal spillovers differs across the countries of the zone. Larger countries have less incentive to free ride because their own behavior affects union-wide borrowing costs. But by the same token, their own policy dilemmas and preferences will determine the cost of public borrowing and the degree of private-sector crowding-out throughout the union. The smaller partners, in contrast, have a limited impact on union-wide variables and are likely to see the largest changes in their own borrowing prospects as a consequence of union. Their weakened incentive for fiscal discipline could encourage a rapid accumulation of public sector liabilities, as it did in some of the smaller countries of the Euro zone.

An unsustainable fiscal situation in one or more of the partner countries will raise difficult issues of burden-sharing, including pressures for inflationary finance and, if the smaller countries are at issue, fiscal bailouts from the larger members. Foreign aid complicates this situation, both as source of fiscal volatility and as potential downside risk to sustainable public spending in all members but Kenya.

RESPONSE: Achieve fiscal convergence and establish adequate surveillance and crisis-management mechanisms before entering the conversion phase.

7.2. External debt spillovers

Divergences in the current account are among the most dramatic developments within the Euro zone. That experience suggests that membership in a monetary union may promote not only fiscal divergences, but also divergences in the accumulation of net foreign liabilities by the private sector (Holinski *et al.* 2012). In particular, borrowing costs in less creditworthy countries may tend to fall as external creditors reassess the risk of depreciation, which now applies to the union-wide currency, and possibly also the risk of default, which may now be limited by an implicit guarantee from union partners. Private borrowers, as well, may fail to internalize the danger their own deteriorating balance sheets impose on the creditworthiness of the union as a whole.

RESPONSE: Establish union-wide surveillance of external debt. Harmonize regulations on currency mismatch and other aspects of financial sector exposure. Decide on the appropriateness of modest union-wide regulations on short-term debt-creating inflows.

7.3. Weak-currency spillovers

Partner States may seek to lock in competitive advantages via devaluation during the convergence phase, leaving union-wide inflation excessively high and conversion rates misaligned with respect to economic fundamentals across union members.

RESPONSE: Achieve inflation convergence and establish rules for choosing appropriate conversion parities before entering the conversion phase.

7.4. Inadequate preparation on the part of EAMI and other institutions of systems and procedures for the successful conduct of union-wide monetary policy

RESPONSE: Build adequate institutional capacity during the convergence phase.

7.5. Inadequate political support for union

Entry into the conversion phase must be understood by foreign exchange markets to be irrevocable. Speculative attacks will occur during the conversion phase if national commitments to defend the conversion parities are not credible.

RESPONSE: Strengthen non-monetary integration. Build domestic political support. Enforce convergence criteria, set appropriate initial parities, and keep the conversion phase short.

8. Summary of findings and recommendations

Figure 7 summarizes our view of the transition process and our recommendations regarding exchange rate arrangements during the transition. During the convergence phase, which we are assuming will be of uncertain duration, we favor continuation of current monetary frameworks characterized by domestic inflation or money growth anchors and managed floating exchange rates. For the two smaller countries of the community, this means continued development of the interbank foreign exchange market in a context of gradually increasing flexibility of market-determined exchange rates.

The leading alternative to this option, and in our view the only realistic alternative, is an internal grid of central parities with fluctuation margins, of the type endorsed for EAC in the ECB report and employed by European countries in the transition to the Euro zone. We have argued that extended exchange rate commitments are not appropriate for the large EAC economies, who made a successful transition away from fixed rates more than a decade ago, and whose capital accounts are open (Tanzania's increasingly so); and we have argued that the ambiguity of inflation anchors that is characteristic of an internal grid system is not likely to be resolved as clearly in the EAC as it was in Europe, which evolved *de facto* into a highly transparent delegated anchor system with Germany at the center.

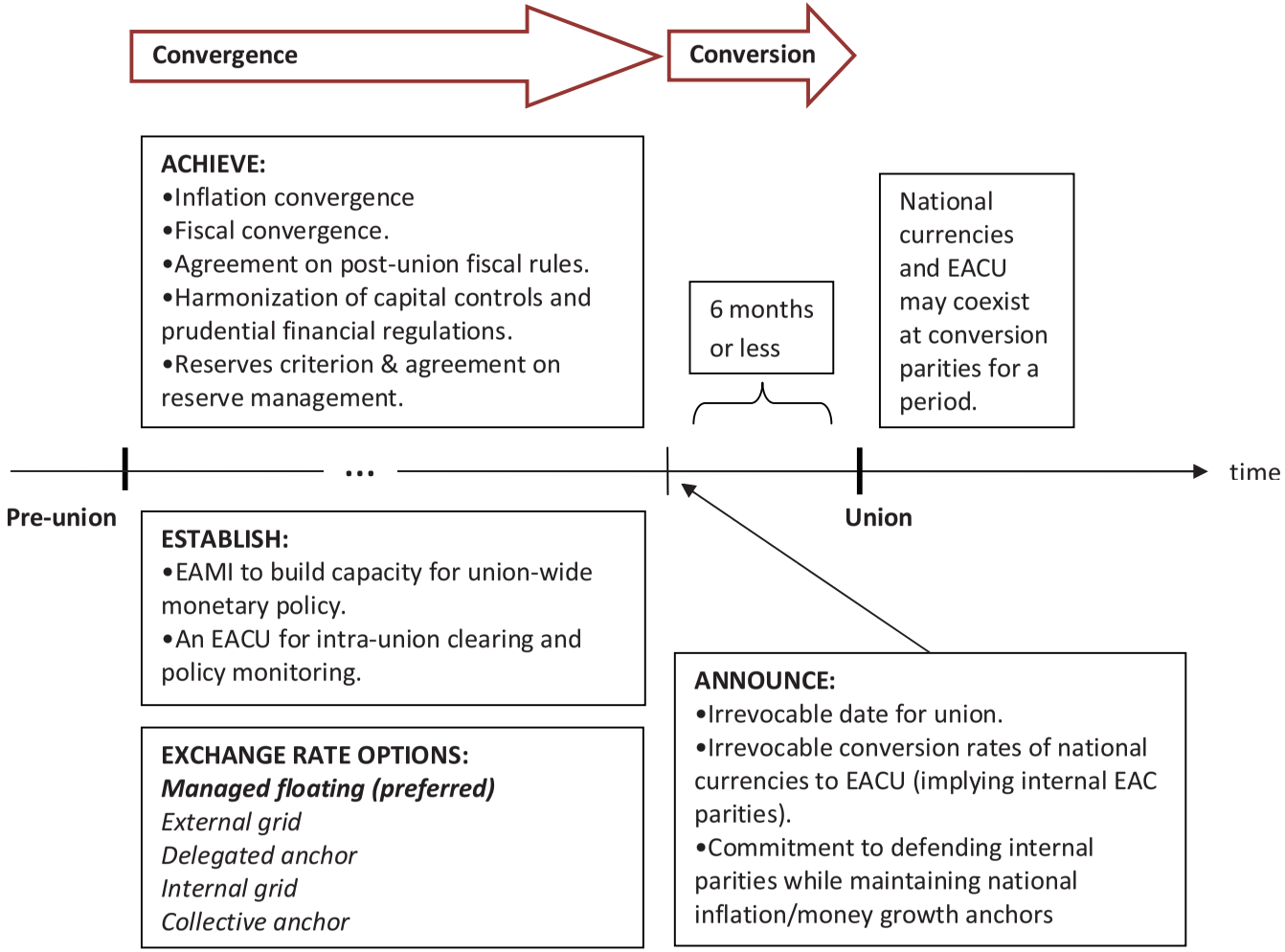
The key difference between the internal grid system and our managed float is that the former imposes an approximate version of the complete ban on intra-union exchange rate movement that will characterize the final entry into union. This has two potentially important implications. First, an internal grid system provides a sharper signal to policymakers and political stakeholders of the potential costs of union. This is because when exchange rates reach the intervention bands, one or more central banks will have to do what is required – including subordinating domestic objectives of monetary policy, for example by sharply increasing interest rates – to defend the bands. Our managed float system, by contrast, is the status quo. We regard this difference as the most important advantage of an internal grid system. We do not regard it as decisive, however, provided that union-wide mechanisms are put in place to monitor convergence criteria in the inflation and fiscal areas and develop post-union fiscal rules.

The second key difference is that if limits on internal exchange rate fluctuations during the convergence phase are credible, their presence may endogenously tend to enhance the flexibility of alternative market mechanisms for adjusting to asymmetric shocks. Improvements in domestic wage and price flexibility, for example, or in the integration of community-wide labor markets, will increase the net benefits of union and may be accelerated if exchange rates are less flexible during the convergence phase. While these benefits may be present, they would have to be weighed against the costs of lower exchange rate flexibility, including slower development of domestic markets in exchange risk. On balance, we favor the managed float.

We have endorsed an internal grid system for the brief conversion phase, with a view to limiting exchange rate misalignments on entry and facilitating a seamless introduction of the EACU into circulation. An EACU might well be introduced early in the convergence phase, as an accounting unit for

intra-community transactions in the public sector and a focus for exchange rate surveillance at the EAC level.

Figure 7 *The transition to monetary union*



Appendix 1
Background data on EAC countries

This appendix provides an economic overview of the East African Community, looking first at macroeconomic data, next at trade linkages and the balance of payments, and finally at openness to capital flows. All EAC countries are classified as low-income by the World Bank. In 2009, PPP-adjusted real income per capita in the EAC was roughly 13 percent of income per capita in South Africa, making the EAC as a whole roughly a third of the size of the South African economy, or a quarter at official exchange rates.

A1.1 Macroeconomic data

Table A1.1 shows that real incomes per capita are broadly similar across the community, with the exception of Burundi where income is roughly 1/3 of the community-wide average. Economic size differs sharply across the community, however, with the 3 largest members accounting for roughly 40, 30 and 20 percent respectively of total EAC GDP at official exchange rates, and Rwanda and Burundi together accounting for less than 10 percent. A variety of structural indicators differentiate the latter two economies from their larger partners: Rwanda and Burundi have larger shares of agriculture in GDP, sharply lower exports, and much higher ratios of aid to imports. Aid is nonetheless quantitatively important for all countries except Kenya.

Economic growth has been considerably faster since 2005 in Rwanda, Tanzania and Uganda than in Burundi and Kenya, with political instability playing a role on both of the latter cases. All five countries, however, show strong external debt positions and healthy international reserves (as detailed further in Table A1.5). Fiscal deficits after grants are below 5% of GDP, but the fiscal position is in some cases heavily dependent on aid; for the community as a whole, the fiscal deficit is more than twice as large before grants as after grants. Inflation has been roughly 10 percent throughout the community, although it increased sharply in the big 3 countries during 2010 and 2011. Nominal depreciation against the US dollar was sharply below inflation in all countries over the half-decade to 2009, implying considerable real appreciation against the US dollar; this situation was partly reversed to some degree in the second half of 2011 when the big 3 countries experiences substantial nominal depreciation against the dollar.

A1.2 Merchandise trade

Tables A1.2a-A1.2c show the role of intra-EAC trade in the total merchandise trade of community members, using data from 2005 to 2010. A sharp distinction emerges between the coastal and landlocked members of the community, in the degree to which they source their merchandise imports from the EAC. For Kenya and Tanzania this is below 5 percent, while for Uganda it is nearly 20 percent and it is above a quarter for Burundi and a third for Rwanda. Export shares to the community vary by less, roughly between 10 and 20 percent of overall merchandise exports. Tanzania and to a lesser degree Uganda are closest to having balanced merchandise trade with community partners, and these two countries are considerably closer to balance in their trade with the region than in their overall trade. Kenya, by contrast, is almost exclusively a net exporter in the community, and Rwanda and Burundi are very substantial net importers. All three of the latter countries have more extreme net positions in their regional trade than in their overall trade.

Table A1.3 shows a very broad breakdown of the commodity-level composition of merchandise trade. Agriculture (mainly food) accounts for more than half of merchandise exports of all five countries, and

over 70 percent in Burundi and Uganda. Manufactured goods account for less than 25 percent of exports except in Kenya, where they account for 35 percent. The import side is equally lopsided, with manufactures accounting for more than 60 percent of imports in all countries. Fuel imports are 20 percent or above in the big three countries, and roughly half that in Burundi and Rwanda.

Table A1.4 measures the degree of concentration of merchandise exports. Coffee and tea are the largest single items for the community as a whole, together accounting for more than 20 percent of exports in all countries except Tanzania. Mineral exports are important in Tanzania and Rwanda.[28] The big three economies are considerably more diversified than the smaller two, but even Burundi and Rwanda are more diversified than Sub-Saharan Africa as a whole. This may reflect the fact that none of these economies is a net oil exporter. Taken together, the EAC economies are as diversified as South Africa.

A1.3 Current account deficits and financing

Figure A1.1 shows the current account deficit, which is large in all cases even after net transfers are taken into account. By 2010 it is close to 10 percent of GDP in all countries except for Burundi, where it is 20 percent of GDP. Net transfers – a category that includes both official aid grants and private unrequited transfers – are substantial in most cases, although surprisingly small in Tanzania. Table A1 suggests that the composition of net transfers varies substantially across countries and that Tanzania's entry may reflect unusually small net private transfers.

Figure A1.2 shows the composition of the current account. A clear distinction emerges between the coastal and landlocked members of the community, with the services trade balance positive in the former case and negative in the latter: this is probably driven by a combination of tourism and, especially, transport.

Figure A1.3 shows how the current account has been financed (after purging the accounts of large offsetting transactions associated with one-time reductions in the stock of government foreign liabilities[29]). Net financial account inflows have grown faster than GDP in all five countries over the course of the 2000s, and all countries have been adding to their international reserves in most years. The two small countries of the zone nonetheless remain much more dependent on capital grants and extraordinary financing than their larger counterparts. Errors and omissions remain relatively small, with the exception of Tanzania where this entry has risen sharply since mid-decade and now provides substantial financing. As suggested above, this may in part reflect unrecorded private transfers. Given Tanzania's relatively tight capital controls, however, it may also reflect unrecorded private capital inflows.

Figure A1.4 shows the breakdown of the financial account. Portfolio flows, whether equity or debt, are negligible in all countries, and net foreign direct investment is negligible in Burundi and Kenya and less than 3 percent of GDP in Rwanda and Tanzania. Instead – with the exception of Uganda, where foreign direct investment has risen to 5 percent of GDP – the financial account tends to be dominated by public sector transactions, as recorded in 'other investment flows' (a category that excludes official reserves, extraordinary financing, and use of Fund credit). This category trends upwards over the course of the decade, discounting a Rwandan outlier in 2002.

[28] These commodity-level observations (coffee, tea, minerals) are drawn from country reports in the UN Comtrade system.

[29] See the footnote to Figure 2.

The composition of 'other investment' inflows appears in Figure A1.5. The monetary authorities make a large and unusual contribution in all countries in 2009, corresponding to a global SDR allocation, but in most years other investment flows are dominated by a combination of 'other sectors' and 'general government'.

Table A1.5 provides additional background on external debt and international reserves, showing the evolution of these variables since 1995. Long-term improvements on both fronts (Burundi's are more recent, beginning around 2007) reflect a combination of economic growth, debt relief, and a concerted effort by all economies to build reserves to prudent levels. As of end-2010, reserves were not far short of the EAC convergence criterion of six months of import coverage, and were at comfortable levels relative to total external debt.

A1.4 Capital account openness

Figure A1.6 shows the normalized Chinn-Ito (2008) measure of *de jure* capital account openness, which runs from zero (the most closed regime on a global basis) to 1 (the most open) and is based on the legal capital account restrictions reported in the IMF's annual *Exchange Arrangements and Exchange Restrictions*. The EAC countries span the full range of the index, with Burundi among the least open countries on a global basis in 2009 and Uganda among the most open.

In Table A1.6 we report a pair of *de facto* measures based on gross transactions in the capital account, again comparing the EAC countries with each other and with regional aggregates. The first measure, denoted "Lane & Milesi-Ferretti" or LMF, is the sum of total external financial assets and liabilities as a share of GDP.[30] This is the stock analog, for the capital account, of a widely used *de facto* measure on the trade side, which proxies openness to trade by the sum of exports and imports of goods and services, divided by GDP. Total assets consist of FDI assets, portfolio equity assets, debt assets, financial derivative assets and foreign exchange reserves (including gold). Total liabilities consist of FDI liabilities, portfolio equity liabilities, debt liabilities and financial derivative liabilities. All stocks are measured in current US dollars and are expressed on an annual basis, relative to US-dollar GDP. The LMF measure shows the ratio of total gross external financial stocks to GDP.

For many low-income countries, transactions that may be best classified as 'non-market' – by or with official entities, and on concessional terms on the liability side – represent a substantial share of total external assets and liabilities. In these cases the LMF measure may overstates the extent to which the economy is engaged with private capital markets. Following Dhungana (2008), therefore, we adjust the LMF measure by deleting, on the asset side, official reserves (excluding gold), and on the liabilities side, concessional debt owed to official donors.[31]

Table A1.6 reports the adjusted and unadjusted LMF measure for the latest available data period, 2005-2008. We show medians rather than means because of the presence of extreme values in the sample; these then to be associated with small economies and ones where GDP at official exchange rates may be

[30] This measure is computed by Philip Lane and Gian Maria Milesi-Ferretti (2007) *The External Wealth of Nations Mark II* (Journal of International Economics, vol 73).

[31] Sandesh Dhungana (2008) "Capital Account Liberalization and Growth Volatility" unpublished BA thesis, Williams College.

significantly under-measured.[32] The data in Table A1.6 confirms Dhungana's finding that Sub-Saharan Africa appears to be significantly less integrated into global capital markets once the non-market flows are excluded.[33] The adjusted measures for East African Economies, however, are low even by comparison with SSA as a whole. Figure A1.7 suggests that within the EAC there has been relatively little change in this de facto measure of capital account openness over the past two decades.[34]

Since stock measures tend by construction to change relatively slowly over time, Figure A1.8 shows a flow version of the unadjusted LMF measure – the ratio of gross financial flows to GDP – for the past decade. With the exception of Tanzania, all EAC countries have seen a trend increase in the ratio of gross external financial transactions to GDP.

[32] In Africa these include Liberia (adjusted openness measure = 863%); Seychelles (240%); Guinea Bissau, 220%; Lesotho (200%); the Gambia (140%) and Sao Tome and Principe (140%).

[33] Indeed the difference may be larger than indicated to the extent that countries in the LAC and ASIA regions such as China, India and Brazil, have been actively accumulating foreign exchange reserves to lean against the appreciation of their nominal exchange rates.

[34] Within the EAC, the data for Burundi appear anomalous suggesting that Burundi is much more open on the capital account than the larger more developed economies, although much of this gap is eliminated when the adjustment is applied. This is consistent with the evidence for small economies with doubtful-quality GDP data and in this case seems to reflect very high external indebtedness.

Table A1.1 *Economic data on the EAC (2009 except where noted)*

Country	Real GDP per capita ($2005 PPP)	Population (millions)	Share of EAC5 GDP (%)		Life expectancy at birth (yrs)	Share of agriculture in GDP (%)	Exports of goods and services (% GDP)	Trade deficit (% GDP)	Net ODA (% of imports)
			at official exchange rates	at inter-national prices					
Burundi	356	8.3	1.8	1.8	51	34.8[1]	10.7[2]	36.2[2]	102.0
Kenya	1,428	39.8	39.7	35.4	55	22.6	25.2	13.1	15.4
Rwanda	1,032	10.0	7.1	6.4	51	34.2	11.7	17.5	61.0
Tanzania	1,237	43.7	29.7	33.7	56	28.8	23.2	11.9	37.2
Uganda	1,105	32.7	21.7	22.5	53	24.7	23.4	11.2	32.0
EAC[4]	1,192	134.6	100.0	100.0	54.4	25.9	23.3	13.1	30.6

Country	M2 (% GDP)	Present value of external debt (% GNI)	Total debt service (% XGSY)	Per-capita growth 2005-09 (%)	Fiscal deficit 2007-09 (% GDP)		CPI inflation rate 2005-09 (%)	Depreci-ation rate vs USD, 2005-10 (%)	Reserves (months of imports)
					after grants	before grants			
Burundi	36.7	13.4	13.3[3]	0.5	-4.1	-22.0	12.0	2.0	7.2
Kenya	42.7	19.4	5.0	2.0	-4.4	-5.7	14.0	0.2	4.0
Rwanda	16.2[1]	8.3	4.7	5.2	-1.3	-10.4	10.6	0.2	5.8
Tanzania	28.8	13.5	3.5	3.9	-3.5	-9.5	8.4	4.5	5.3
Uganda	20.6	8.2	2.0	4.8	-2.1	-5.0	9.4	2.2	6.4
EAC[4]	31.8	14.4	4.0	3.4	-3.4	-7.3	11.0	1.8	5.0

Source: World Bank, *World Development Indicators* online, except for the government deficit which is from IMF Country Reports.
[1]Data for 2005; [2]Data for 2006; [3]Data for 2008; [4]For calculating EAC aggregates, missing 2009 data were replaced by the entries in the table.
Notes: XGSY denotes exports of goods, services and income. EAC-wide growth is weighted by 2009 PPP-adjusted GDP shares. EAC-wide government deficit, CPI inflation and depreciation are weighted by 2009 GDP shares at official exchange rates.

Table A1.2a *Direction of Merchandise Exports in the EAC (2005-2010)*
[share of column in total merchandise exports of row (%)]

	Burundi	Kenya	Rwanda	Tanzania	Uganda	EAC
Burundi	--	5.6	3.8	0.8	1.6	11.8
Kenya	0.8	--	3.0	8.5	11.4	23.6
Rwanda	1.4	16.6	--	0.2	1.4	19.6
Tanzania	1.4	4.4	1.5	--	2.1	9.4
Uganda	2.6	8.8	7.9	1.7	--	21.1

Table A1.2b *Direction of Merchandise Imports in the EAC (2005-2010)*
[share of column in total merchandise imports of row (%)]

	Burundi	Kenya	Rwanda	Tanzania	Uganda	EAC
Burundi	--	9.5	0.9	5.7	9.2	25.3
Kenya	0.0	--	0.0	1.0	0.6	1.6
Rwanda	0.6	17.3	--	4.3	15.0	37.1
Tanzania	0.0	4.4	0.0	--	0.2	4.6
Uganda	0.1	17.1	0.1	1.5	--	18.7

Table A1.2c *Ratio of merchandise imports to merchandise exports*

	Burundi	Kenya	Rwanda	Tanzania	Uganda	EAC
Overall	2.7	2.2	4.0	2.3	2.0	2.5
Within EAC	5.7	0.1	7.5	1.1	1.8	0.9[1]

Source: UNCTAD (www.unctad.org Statistics portal)
[1]This entry should be 1.0, but in the UNCTAD data, exports to EAC reported by Tanzania exceed imports from Tanzania reported by the remaining partners.

Table A1.3 *Shares of merchandise trade by broad commodity level (percent)*

	Burundi	Kenya	Rwanda	Tanzania	Uganda	EAC
EXPORTS						
Food	72.74	41.98	57.20	49.25	65.51	49.18
Raw Agriculture	5.71	12.00	3.59	11.36	8.99	10.85
Fuel	1.80	7.98	0.01	1.06	2.39	4.92
Metals	5.21	2.62	35.30	15.92	2.42	6.88
Manufactures	14.25	35.36	3.90	21.67	20.59	27.92
IMPORTS						
Food	13.07	10.34	12.42	10.29	13.75	11.06
Raw Agriculture	1.22	1.71	1.99	0.86	1.25	1.39
Fuel	10.21	23.93	11.35	26.41	19.60	23.01
Metals	1.68	1.84	2.55	1.32	1.15	1.60
Manufactures	73.12	61.79	71.68	60.85	62.96	62.42

Source: World Bank, *World Development Indicators* online.

Table A1.4 *Concentration of merchandise exports (average index, 2005-10)*

Burundi	Kenya	Rwanda	Tanzania	Uganda	EAC	South Africa	SSA x South Africa	Emerging Economies
0.483	0.194	0.424	0.199	0.222	0.142	0.152	0.585	0.103

Source: UNCTAD.
Note: The concentration index is a Herfindahl-Hirschmann index of 3-digit merchandise export values (SITC Revision 3). It lies between 0 and 1, with an increase denoting greater concentration.

Table A1.5 *External debt and international reserves*

Country	year	Total external debt				Total reserves minus gold			
		Ratio to GNI (%)	Ratio of present value to GNI (%)	Conces-sional share (%)	Ratio of short-term to total (%)	Ratio to external debt (%)	Months of imports	Ratio of short-term debt to reserves (%)	Ratio of M2 to reserves (%)
Burundi	1995	118	90	7	1	18	9.7	--	0.9
	2005	170	91	34	3	8	3.7	--	2.6
	2010	34	74	5	3	62	6.5	14	1.9
Kenya	1995	84	53	165	9	5	0.7	--	10.8
	2005	34	77	28	8	28	3.2	--	4.1
	2010	27	77	23	12	51	3.8	20	3.7
Rwanda	1995	79	94	32	3	10	3.2	--	2.4
	2005	59	94	4	1	27	7.4	--	1.1
	2010	14	96	2	2	102	5.9	--	--
Tanzania	1995	144	60	357	13.	4	1.5	--	4.9
	2005	59	73	49	12	25	5.8	--	1.8
	2010	38	60	39	17	45	5.2	23	2.0
Uganda	1995	63	77	22	3	13	3.7	--	1.4
	2005	49	91	6	2	31	6.9	--	1.3
	2010	18	86	11	10	95	7	5.6	1.5

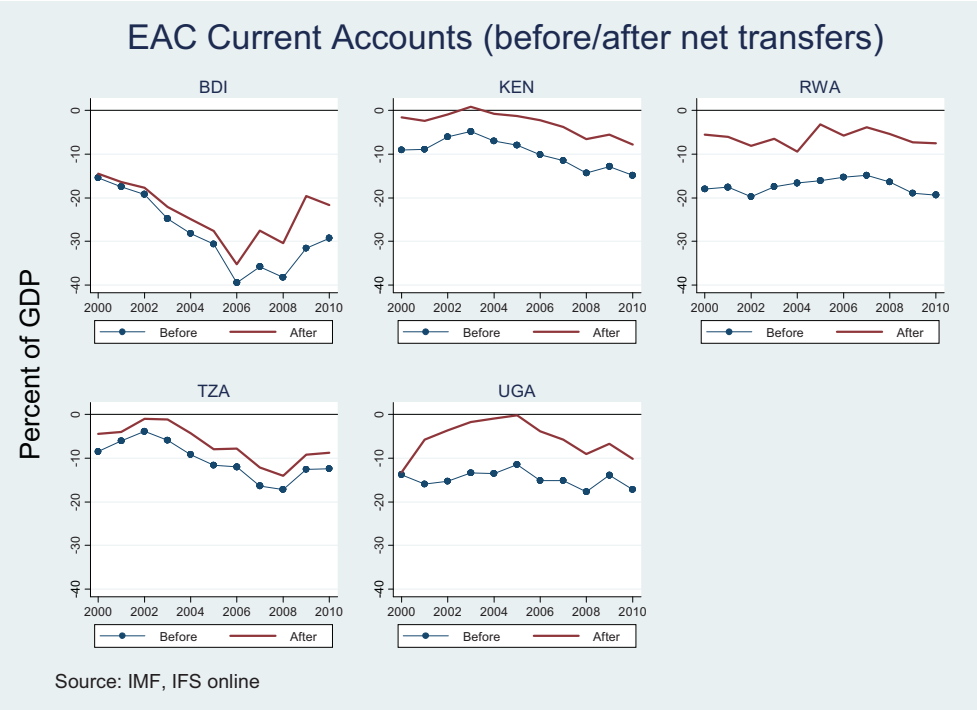
Source: World Bank, *World Development Indicators* online.

Table A1.6 *De facto measures of capital account openness*
[share of GDP (%), group and period medians]

	Lane & Milesi-Ferretti 2005-2008	Adjusted LMF 2005-2008
Region		
OECD	415	409
Latin America and Caribbean	155	127
South and East Asia	144	95
Africa	122	71
EAC	87	47
Country		
Burundi	217	64
Kenya	74	41
Rwanda	62	33
Tanzania	87	53
Uganda	88	55
South Africa	157	148

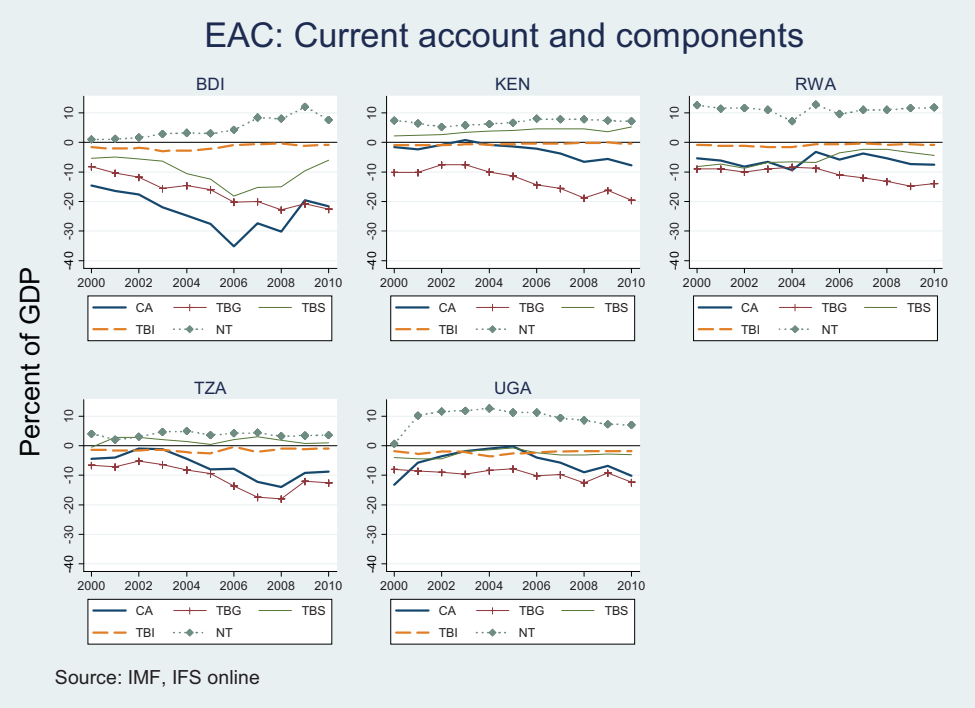
Source: Lane and Milesi-Ferretti (20087); World Development Indicators and Global Development Finance.

Figure A1.1 *Current account before and after net transfers*



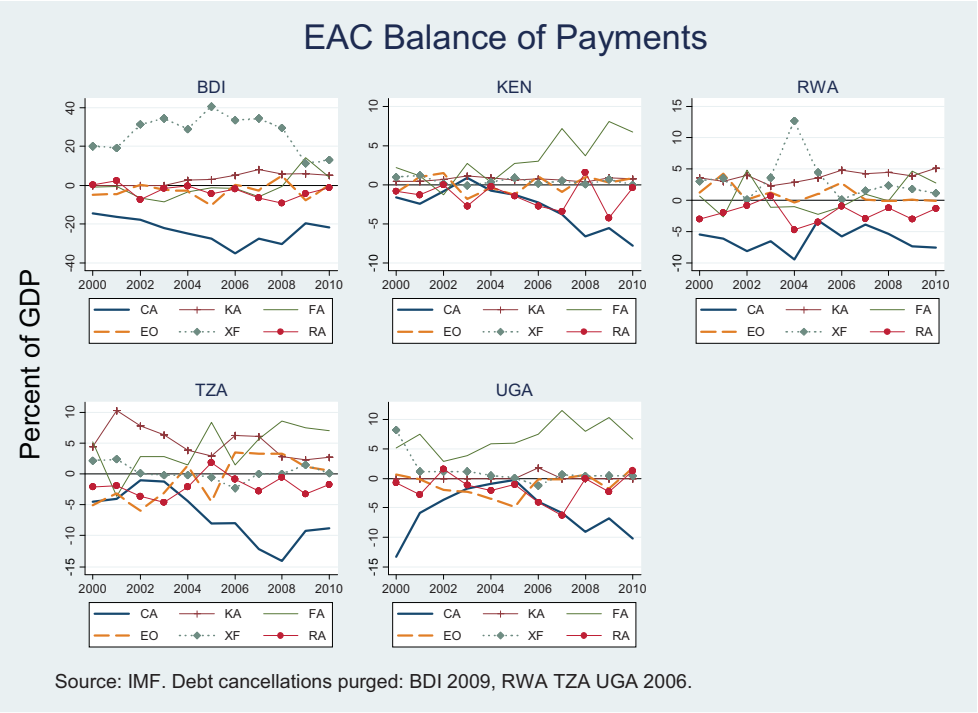
Note: The current account before net transfers is the CA on goods, services and income.

Figure A1.2 *Composition of the current account*



Key: CA= Current Account (after net transfers); TBG/TBS/TBI = Trade Balances in Goods/Services/Income. NT = Net transfers.

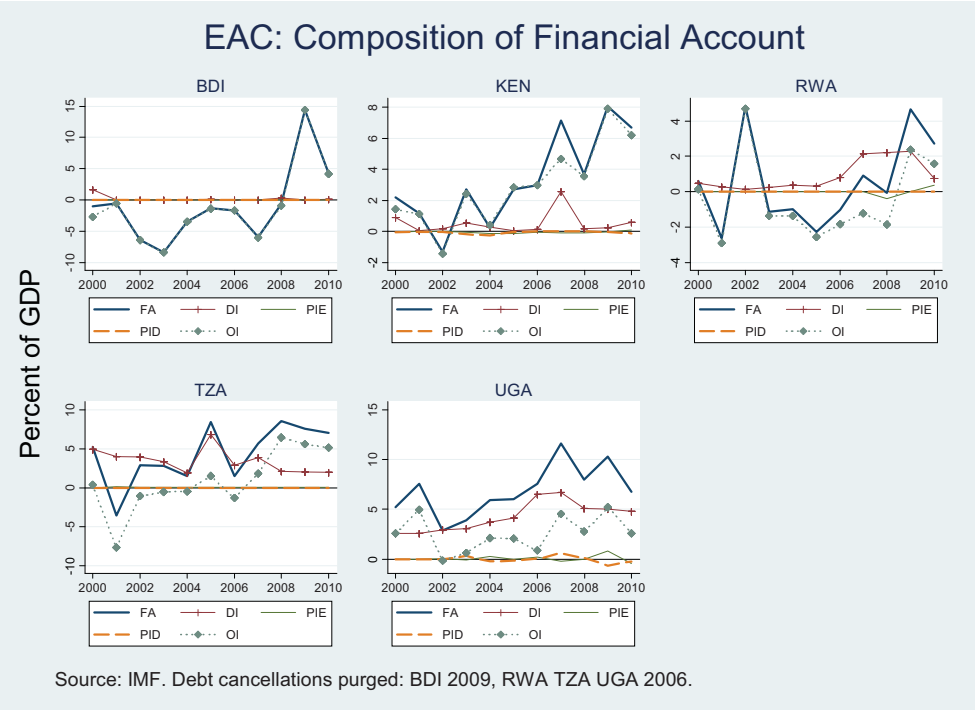
Figure A1.3 *Current account and financing*



Source: IMF. Debt cancellations purged: BDI 2009, RWA TZA UGA 2006.

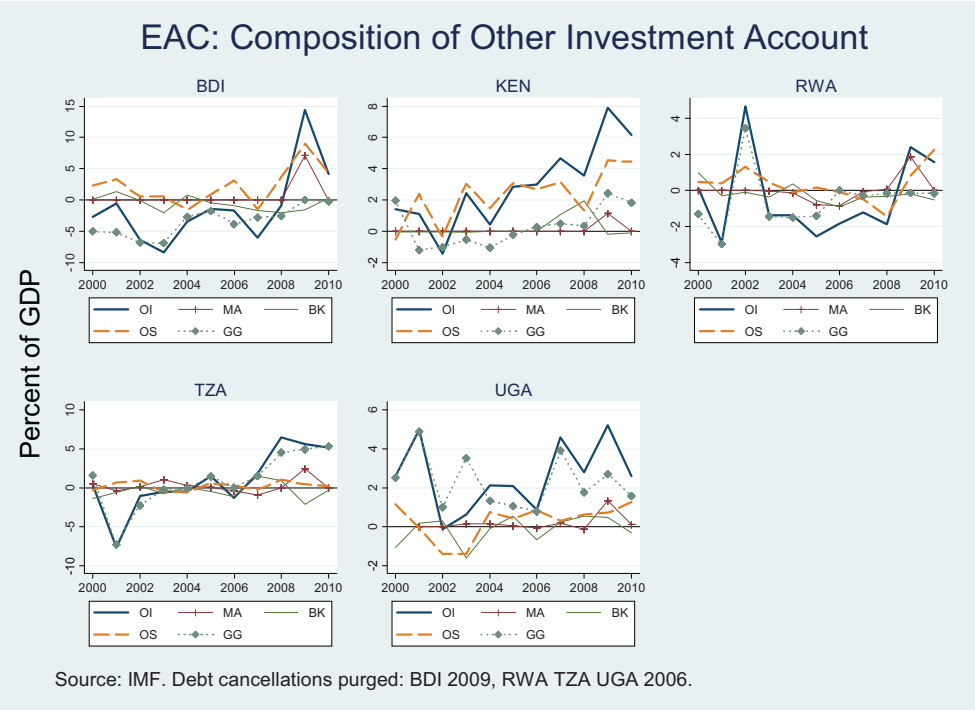
Key: CA= Current Account (after net transfers); KA = Capital Account, Net; FA = Financial Account, Net; EO = Errors and Omissions; XF = Extraordinary Financing + Use of Fund Credit; RA = Reserve Assets, Net.
Note: To maintain scaling, we have purged the accounts of large one-time reductions in government foreign liabilities (in Burundi, an inflow of extraordinary financing reduced government foreign investment liabilities by 71% of GDP in 2009; in Rwanda and Tanzania, respectively, a capital account grant reduced government foreign investment liabilities by 38 and 30 percent of GDP in 2006; and in Uganda, a capital account grant reduced extraordinary financing by 33 percent of GDP in 2006). In each case we removed both sides of the transaction, in order to leave the overall balance of payments identity intact.

Figure A1.4 *Composition of the financial account*



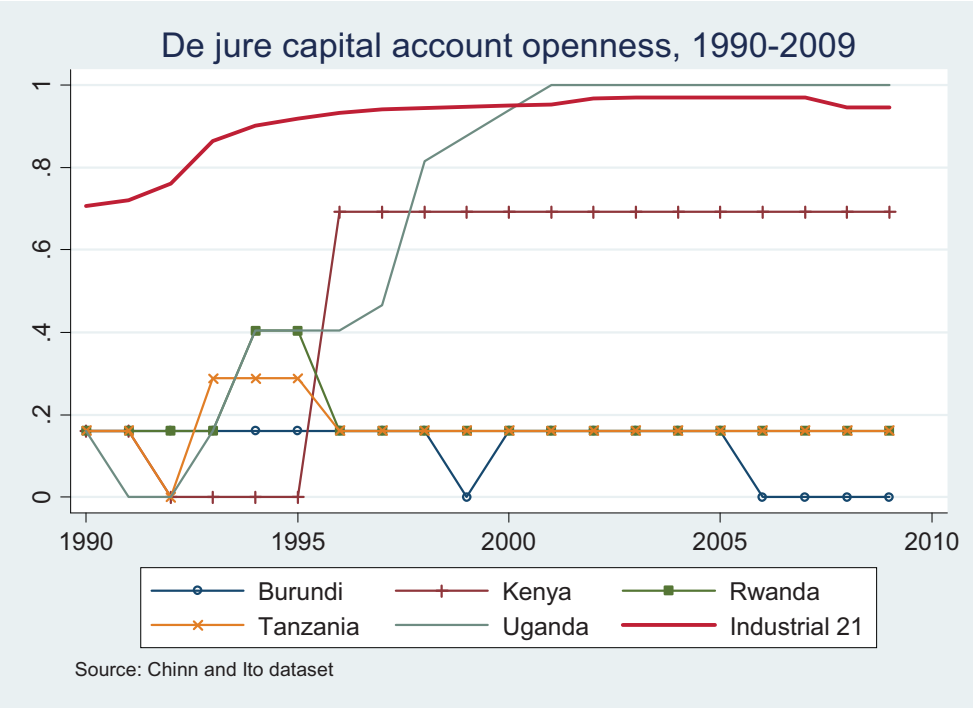
See note to Fig A1.1. Key: FA= Financial Account, Net, consisting of the following categories: DI = Direct Investment, Net; PIE = Portfolio Investment, Equity, Net; PID = Portfolio Investment, Debt, Net; OI = Other Investment, Net.

Figure A1.5 *Composition of the 'other investment' account*



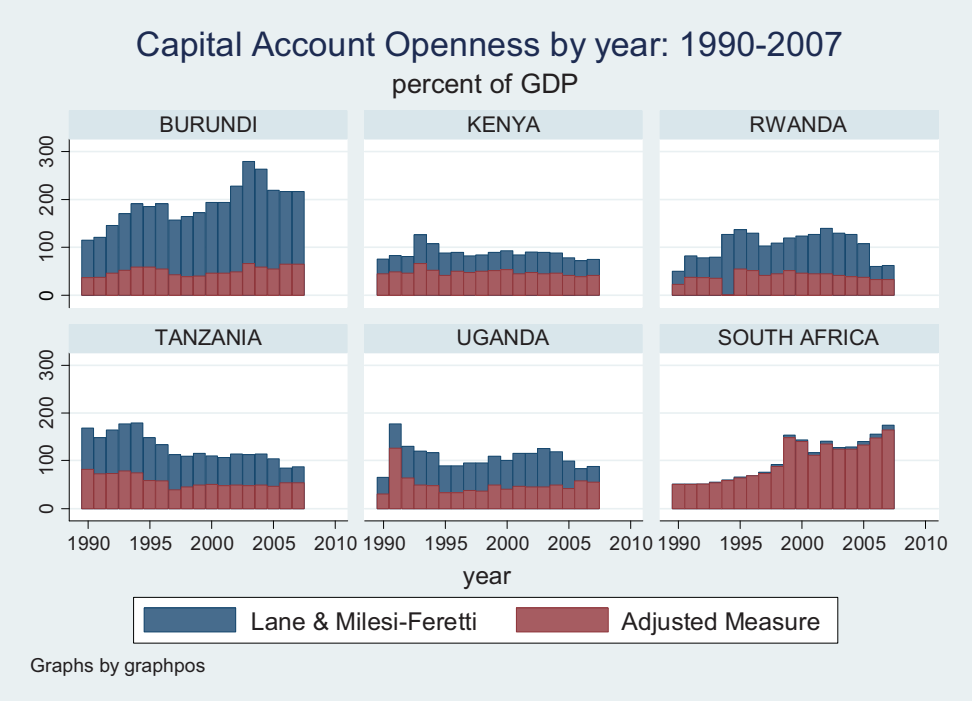
See note to Figure A1.1. Key: OI= Other Investment, Net, consisting of the following sub-categories: MA = Monetary Authorities, Net; BK = Banks, Net; OS = Other Sectors, Net; GG = General Government, Net.

Figure A1.6 *De jure capital account openness in the EAC, 1990-2007*



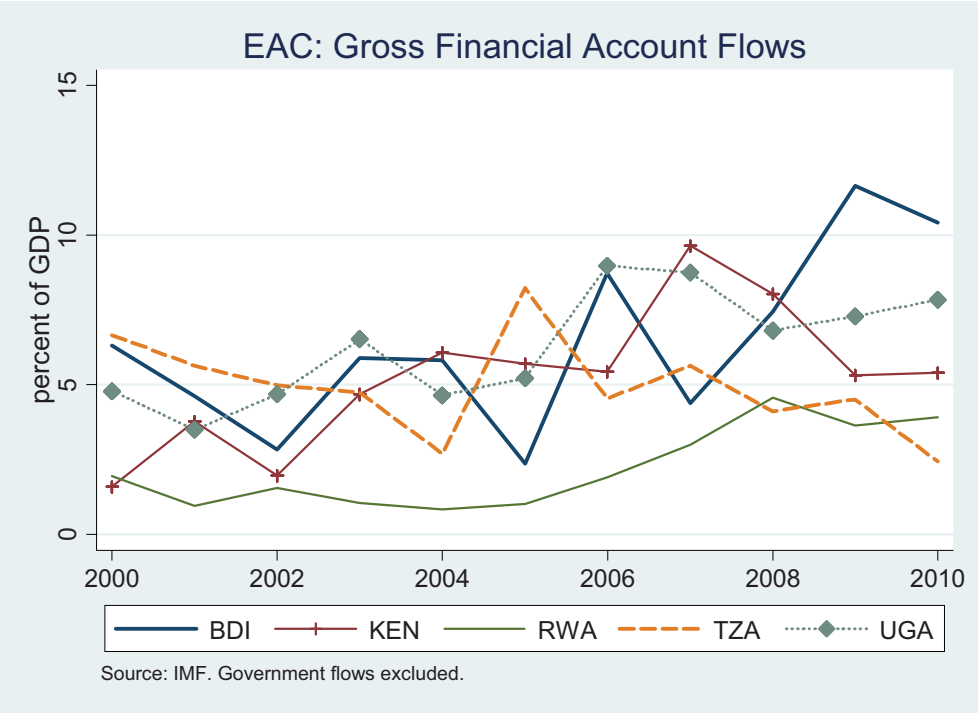
Source: Chinn and Ito (2008), as normalized and updated (http://web.pdx.edu/~ito/trilemma_indexes.htm).

Figure A1.7 *De facto capital account openness in the EAC, 1990-2007*



Source: Lane and Milesi-Ferretti (20087); World Development Indicators and Global Development Finance.

Figure A1.8 *Gross financial account flows*



Source: IMF. Gross financial flows consist of foreign direct investment, portfolio flows, financial derivatives, and long-term debt flows (denoted 'other investment' in the *International Financial Statistics*). Our measure of long-term debt flows omits flows attributed to 'general government' or 'monetary authority'.

Appendix 2
Capital mobility and monetary policy in the EAC

Figure A2.1 – A2.3 show impulse responses from a structural VAR designed to assess the degree to which short-term capital mobility constrains monetary policy in EAC countries. The variables of the VAR are the change in net domestic assets (NDA) of the central bank, the change net foreign assets of the central bank (NFA) – both purged of exchange-rate valuation effects in order to focus on balance-sheet transactions by the central bank – and the rate of depreciation of the home currency against the US dollar. To identify the VAR, we model its reduced-form innovations as linear combinations of three underlying structural shocks:

- A shock to monetary policy, modeled as a shock to the central bank's net domestic assets as in a reserve-money program.
- A self-sterilizing shock to central-bank foreign-exchange holdings, arising from central-bank management of the accrual or use of foreign exchange by other parts of the public sector (the receipt of donor assistance, for example, increases the central bank's foreign exchange reserves and generates an offsetting entry for net domestic assets, leaving the monetary base contemporaneously unchanged; a shock to government spending on imports has a similar effect with opposite signs).
- A shock to the private sector's balance of payments.

Given mutual orthogonality of the structural shocks, three restrictions on the relationship between the structural shocks and the reduced-form innovations are required to identify the VAR. We assume (1) that the self-sterilizing shock produces equal and opposite contemporaneous changes in NFA and NDA; (2) that the exchange rate does not respond contemporaneously to the self-sterilizing shock; and (3) that monetary policy does not respond contemporaneously to the exchange rate. We leave other contemporaneous responses unrestricted, producing a just-identified VAR. We estimate the VAR on a country-by-country basis for four of the five EAC countries[35], using monthly data from 2001m1 to the present and including 7 lags and a set of centered seasonal dummies in all specifications. Further details appear in our background note (Adam, Kessy and O'Connell 2012).

Figures A2.1 – A2.3 focus on the dynamic responses of reserves and the exchange rate to shocks to monetary policy. We normalize the NDA shocks so that they are equal to one percent of the monetary base. In a fixed or heavily-managed exchange rate regime, the short-run response of NFA to NDA is known as the *offset coefficient* and is interpreted as a reflection of the degree of short-term capital mobility. The logic is that a monetary expansion reduces the interest rates on domestic securities, and with a fixed exchange rate, the implied reduction in the expected foreign-currency yield on these assets leads to a short-term capital outflow. If short-term capital mobility is high, the degree of offset will be

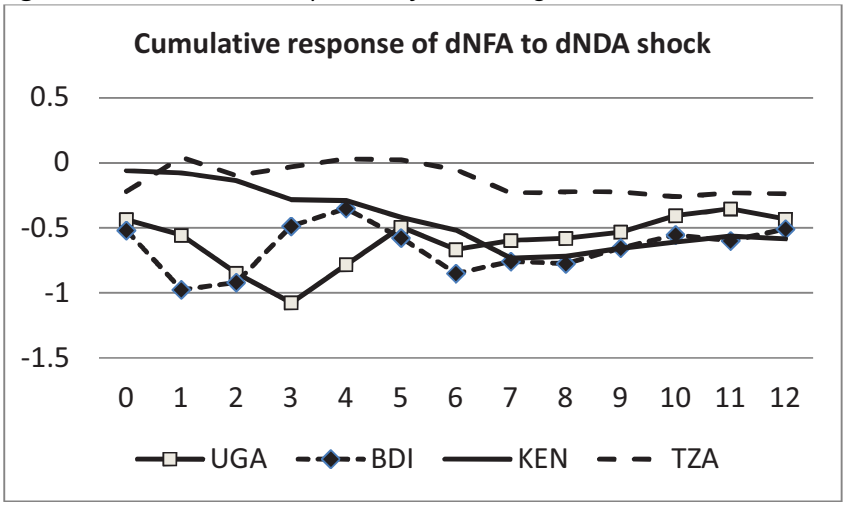
[35] We were unable to estimate a satisfactory model for Rwanda, where exchange rate management changed sharply in 2004. Incorporating a shift dummy in 2004m1 did not resolve this issue, which we leave for future research.

rapid and close to 1 in magnitude. Under a flexible exchange-rate regime, a similar logic operates through the exchange rate: the desired capital outflow produces a depreciation, the size of which is an increasing function of the degree of short-term capital mobility.

Figures A2.1 and A2.2 show the offset coefficient and the exchange rate effect, respectively. In Figure A2.3 we put the two pieces together and track the impact of a monetary expansion on *exchange market pressure*, defined here as the sum of percentage reserve losses and exchange rate depreciation. This variable is constructed to be robust to cross-country differences in the degree of exchange-rate flexibility: a high degree of short-term capital mobility will produce an increase in exchange-market pressures whether the central bank chooses to spend reserves or allow the exchange rate to depreciate.

The responses in Figure A2.3 suggest that portfolio behavior imposes non-trivial constraints on monetary policy in the EAC. Kenya and Uganda show the largest point estimates, consistent with their open capital accounts and the relative sophistication of their inter-bank foreign exchange markets and markets for government securities.

Figure A2.1 *Cumulative responses of Net Foreign Assets to a shock to Net Domestic Assets*



Notes: The figure shows the first 12 months of the cumulative impulse response. These point estimates are from a just-identified VAR in Δlog(*NDA*), Δlog(*NFA*) and Δ*EMP*.

Figure A2.2 *Cumulative responses of the Exchange Rate to a shock to Net Domestic Assets*

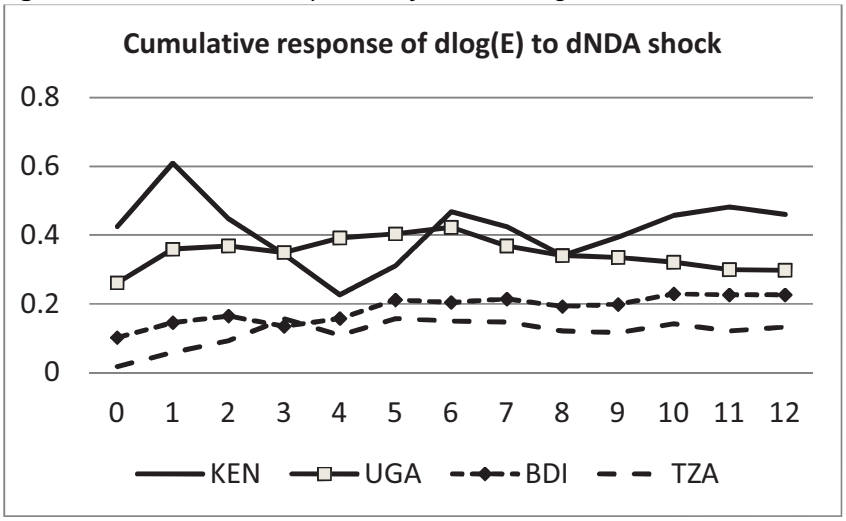
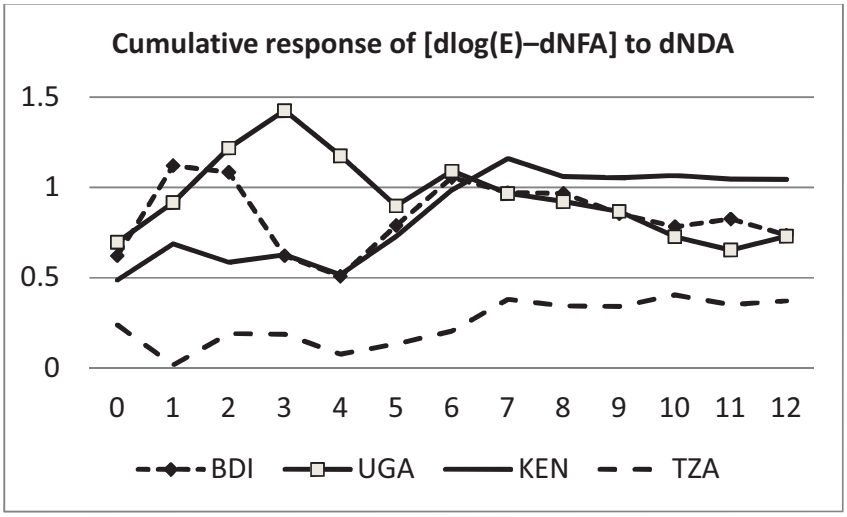


Figure A2.3 *Cumulative responses of Exchange Market Pressure to a shock to Net Domestic Assets*



Appendix Table 1 Summary of Exchange Rate Arrangements in EAC Countries

	Burundi	Kenya	Rwanda	Tanzania	Uganda
Regime classification and exchange rate objectives	**IMF *de facto* classification:** "Other conventional peg arrangement" – "stabilized" System is seen as transitional arrangement designed to support a market-determined exchange rate, and to encourage development of the inter-bank foreign exchange market.	**IMF *de facto* classification:** "Managed floating with no pre-determined path for the exchange rate" Official intervention does not target exchange rate but will seek to smooth volatility. CBK also intervenes in forex markets to meet official reserve targets, finance government imports, and as part of liquidity management objectives under reserve money programme.	**IMF *de facto* classification:** "Crawl-like peg arrangement" [re-classified from "stabilized" in 2010.] System is in transition from fixed exchange rate, which prevailed prior to 1995, to fully market-determined rate. Currently moving towards greater flexibility in support of reserve money anchor, with official intervention limited to smoothing volatility.	**IMF *de facto* classification:** "Managed floating with no pre-determined path for the exchange rate" Official intervention does not target exchange rate but will seek to smooth volatility. BoT also intervenes in forex markets in order to meet official reserve targets and as part of liquidity management objectives under reserve money programme.	**IMF *de facto* classification:** "Managed floating with no pre-determined path for the exchange rate" Official intervention does not target exchange rate but will seek to smooth volatility. BoU will also intervene in forex markets in order to meet official reserve targets and as part of liquidity management objectives under reserve money programme.
Structure and operation of forex market	A single daily forex auction supplemented by transactions at BRB window. Auction typically consists of 2-3 banks (out of a total of 8) and tends to clear at prices very close to official rate (with BRB is held	Interbank market open to all licensed banking institutions. Market operates daily and is perceived to be fairly competitive. CBK is a relatively small player.	Interbank market in process of being developed. 'Corridor' system introduced in July 2010 as transitional arrangement to market-determined official rate.	All commercial banks plus central bank participate in interbank foreign exchange market (IFEM). Market operates via daily screen-based auctions. Official rate is volume-	Market consists of 22 members of whom 6 are designated as primary dealers. Market operates via daily screen-based auctions. Official rate is volume-weighted average of

		Official rate is determined by volume-weighted average of buy/sell quotes of 18 commercial banks (accounting for around 90% of all forex transactions).	Corridor functions as a crawling peg, determining daily limits on exchange rate movements. BNR will sell/buy at upper/lower corridor limits. Official rate (Average Reference Rate) currently calculated as 5-day moving average of banks' transactions with customers and BNR intervention rate. ARR to be replaced by unified official rate in 2011. .	weighted average of previous day's trades. and is used to price off-market transactions and for valuation. Formal limits were placed on daily exchange rate movements when IFEM was established; these are no longer operative although may act as market 'norm'. Market perceived to be reasonably competitive although coordinated behaviour by banks – reflecting correlated demands of customers – can move rates in the short run (e.g. as customers seek Shilling liquidity to meet tax obligations). Government imports are not financed through IFEM while large private transactions may be handled off market and/or offshore.	previous day's trades. Official rate is used to price off-market transactions and for valuation. Market is 'reasonably competitive' although recently off-shore financial institutions have been taking speculative positions against the Uganda Shillings large enough to move rates.
Principal sources of exchange market	Export earnings still limited. Aid flows dominate market	Principal sources of pressure come from capital and services	Export earnings dominated by coffee but this accounts for	Strong but predictable seasonality in export earnings (cash crops	Strong but predictable seasonality in cash crops revenues

pressures	inflows. Some concerns about retail capital flight via bureaux de changes.	accounts especially from perception-sensitive flows (private capital flows, tourism, aid and remittances). Remainder of current account becoming more diversified over time.	small share of imports. Aid flows account for 50% of inflows.	and tourism), increasingly smoothed by gold, other natural resource and trans-shipment earnings, although volatility in global commodity prices a source of market pressures. Aid flows remain large but are either self-liquidating through imports or incorporated into reserve money programme. Import demand broadly stable and/or predictable (e.g. oil shipments). Large imports tend to be financed off-shore (private sector) or off-market (public sector)	compounded by high price volatility. Aid flows currently large and erratic Oil revenues will emerge as source of EMP in due course. Private remittances and portfolio capital flows becoming increasingly important and volatile sources of inflows.
Central bank participation and public sector transactions	BRB is major player and market maker, reflecting importance of aid flows.	CBK forex operations are modest compared to size of market. Net sales determined within monetary framework geared to meeting RM target with minimum volatility in domestic interest rates (and exchange rate). Residual liquidity management	Because of scale of aid flows, BNR remains decisive player in forex market (on the selling side).	BoT is a consistent net seller of forex. Volume of sales determined by annual monetary framework which is translated into a monthly operational programme by MPC, setting proposed net forex sales coordinated with open market operations in T-bill.	BoU forex operations (principally sales of aid inflows) determined within monetary framework geared to meeting RM target with minimum volatility in domestic interest rates (and exchange rate). Residual liquidity management

		instrument is the REPO. Purchases – to meet reserve requirements and to finance government imports go through forex market.		Objective is to meet target for RM with minimum volatility in domestic interest rates (and exchange rate). RM programme is transparent so BoT forex sales are anticipated by market participants Residual liquidity management instrument is the REPO. Government imports, esp capex, do not go through IFEM but are financed directly from reserves. Transactions are priced at official rate.	instrument is the REPO.
Capital Controls	Restrictions on residents' foreign borrowing and lending	There are essentially no controls on capital flows, either inward or outward; Limit on non-EAC resident purchases of equity in Kenyan listed firms.	There are no controls on capital flows, either inward or outward. Various capital account transactions require BNR approval. However no apparent exposure to short-term private capital flows due to thinness of financial markets.	Capital account is partially closed. Key limitations on non-resident participation in equity, government debt and money markets. BoT has programme for progressive removal of remaining control 2010-2015. Many existing controls relatively easy to	There are no controls on capital flows, either inward or outward. Various capital account transactions require BoU approval.

				circumvent.	
Communication and dissemination	BRB at early stages of developing communication strategy	CBK has developed contemporary engagement strategy built around MPC with independent members. Currently under review by ex-Bank of England MPC member.	BNR developing a communication strategy built around regular MPC meetings	BoT has active engagement strategy centred on MPC meetings. BoT undertakes post-meeting briefing of bank CEOs and maintains regular communication through media.	BoU has active MPC-based engagement strategy with banks.

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Short-Run Capital Mobility in the East African Community: A Structural VAR Approach

Christopher Adam, Pantaleo Kessy, and Stephen O'Connell[1]

December 20, 2012

1. Introduction

This note summarizes a set of exploratory structural VAR estimates designed to assess the degree of short-term capital mobility in the countries of the EACs by examining the dynamic relationships between changes in net domestic assets ($dNFAM$), changes in net foreign assets ($dNDAM$), and exchange rate depreciation ($dlogE$).

We focus on impulse responses calculated from VARs in $[dNFAM, dNDAM, dlogE]$ for Uganda, Kenya and Tanzania. Here *NFAM* and *NDAM* are values of net foreign assets and net domestic assets that are adjusted to exclude exchange-rate valuation effects (changes due to the impact of exchange rate movements, rather than central bank transactions). Briefly, the logic of this 3-variable system is that the responses of *dNFAM* and *dlogE* to *dNDAM* should provide evidence on the importance of short-run capital mobility; the response of *dNDAM* to *dNFAM* should provide evidence on the degree of sterilization of foreign-exchange transactions; and the responses of *dNDAM* and *dNFAM* to *dlogE* should provide evidence on the degree to which balance of payments shocks constrain monetary policy. Appendix 1 motivates our approach, paying particular attention to the importance of aid flows and other self-sterilizing intra-public-sector transactions on the balance sheets of EAC central banks. Appendix 2 describes how we purged the central bank balance sheet data from exchange-rate valuation effects.

The estimation period is 2002m1 to 2011m5. We estimate these VARs with 7 lags, although the AIC and SBC criteria typically indicate only 0 or 1 lags (these tests are not conditional on seasonal dummies, but the estimation is).

2. Choleski factorization

We start with a Choleski factorization in which shocks to the change in net foreign assets come first, net domestic assets second, and the exchange rate third. This ordering allows net foreign assets to be the driving shock in the system in the very short run, and allows the exchange rate to respond contemporaneously to all variables.

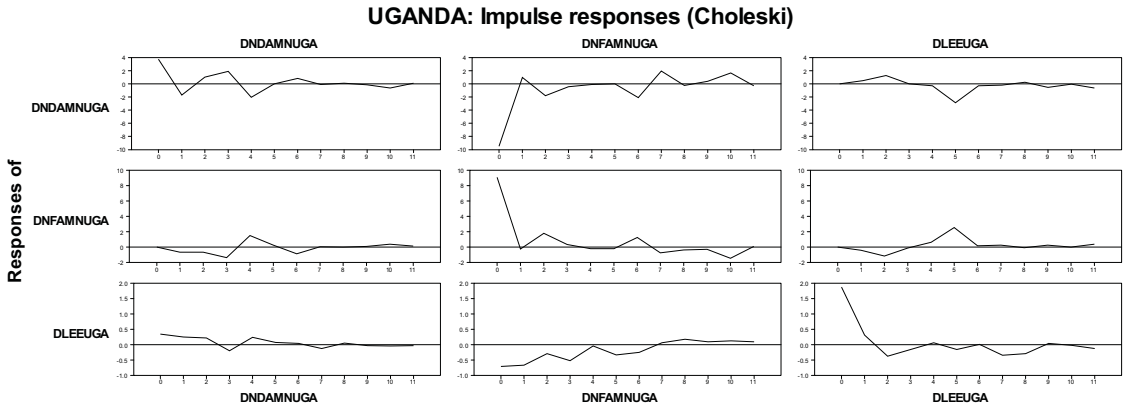
Qualitatively, the results generally make sense, although only the large contemporaneous impacts are probably statistically significant.

The results for Uganda appear in Figure 1. In column 2, a positive shock to net foreign assets produces an immediate change in net domestic assets in the opposite direction, implying almost complete contemporaneous sterilization of central bank foreign exchange transactions. The same shock nonetheless strengthens the exchange rate, and this effect is somewhat persistent. In column 1, an expansionary shock to net domestic assets depreciates the nominal exchange rate and leads to a very modest depletion of net foreign assets, suggesting a small degree of offset through the capital account over a period of a few months. In column 3, an unanticipated depreciation of the nominal exchange

[1] Oxford University and International Growth Centre (IGC), Central Bank of Tanzania and IGC, and Swarthmore College and IGC. This is a background note to C. Adam, P. Kessy, C. Kombe and S. O'Connell (2012) "Exchange Rate Arrangements in the Transition to Monetary Union" Central Bank of Tanzania and International Growth Centre, February. We are grateful to Richard Peck for excellent research assistance.

rate is associated with a small and transitory countervailing foreign exchange intervention that appears to be sterilized.

Fig 1 *UGANDA impulse responses (Choleski factorization)*



The results for Kenya appear in Figure 2. In column 1, evidence of offset behavior is weaker than in Uganda: a shock to domestic credit puts only very transitory pressure on the exchange rate and produces a very small reserve inflow rather than an outflow. In the second column, contemporaneous sterilization is again extremely high, and favorable shocks to net foreign assets generate a similar tendency as in Uganda, towards moderately persistent nominal appreciation. In the final column, shocks to the exchange rate produce a similarly modest but more persistent pattern of stabilizing sterilized intervention.

Fig 2 *KENYA impulse responses (Choleski factorization)*

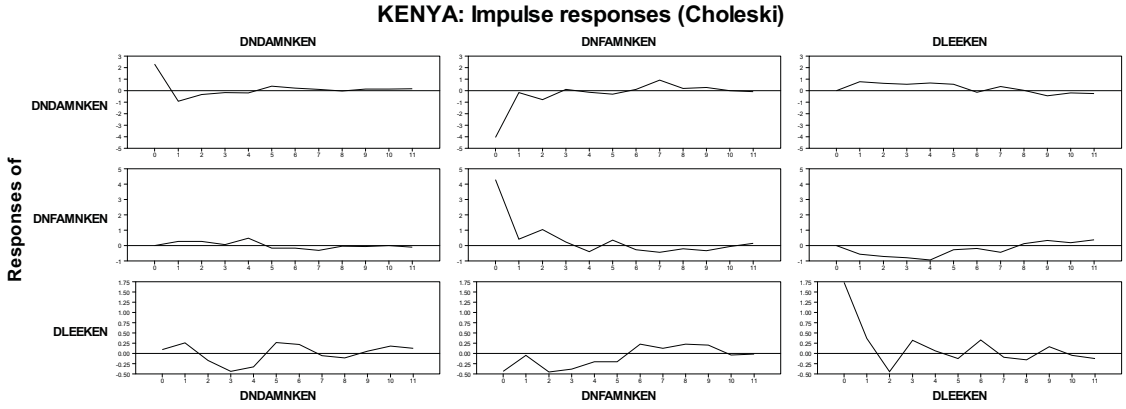


Figure 3 shows Tanzania. Shocks to domestic credit produce a small and lagged increase in exchange rate depreciation and no impact on net foreign assets beyond a small lagged increase the month after the shock. Contemporaneous sterilization is nearly complete as in the other countries. Shocks to the exchange rate produce very little impact on the central bank's balance sheet.

Fig 3 *TANZANIA impulse responses (Choleski factorization)*

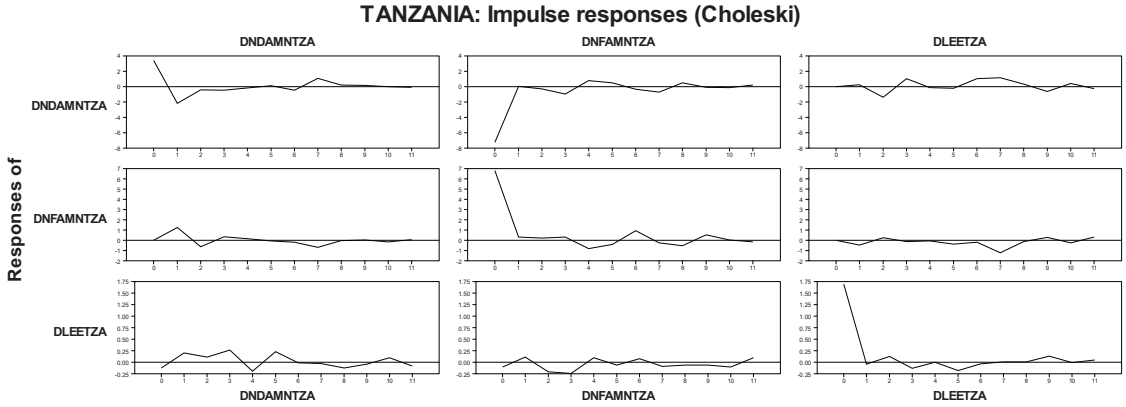
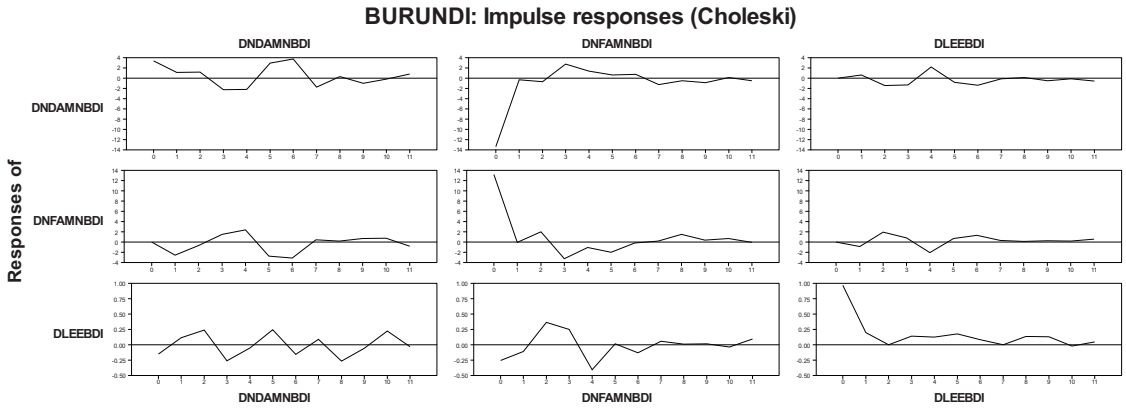


Fig 3a *BURUNDI impulse responses (Choleski factorization)*



Burundi's results appear in Figure 3a. In the first column, shocks to domestic credit produce a small lagged decrease in foreign assets and an irregular pattern in the rate of depreciation. Shocks to self-sterilizing flows are very large and create a small transitory appreciation that is quickly reversed. Shocks to the rate of depreciation are reasonably persistent and produce only a small response on the central bank's balance sheet.

3. Structural VAR with identified orthogonal shocks

As an alternative approach we apply the structural VAR identification suggested in Appendix 1. This approach assumes that the reduced-form innovations represent linear combinations of mutually orthogonal shocks to (1) domestic monetary policy (v_1), (2) self-sterilizing central bank transactions in foreign exchange, associated for example with the receipt or spending of aid (v_2), and (3) the private sector balance of payments (v_3). Thus $u = Bv$, where the matrix B is identified via the restrictions $b_{13} = 0,\ b_{12} = -b_{22}$, and $b_{32} = 0$:[2]

[2] By contrast, the Choleski factorization amounts to imposing $b_{13} = b_{21} = b_{23} = 0$.

$$B = \begin{bmatrix} b_{11} & -b_{22} & 0 \\ b_{21} & b_{22} & b_{23} \\ b_{31} & 0 & b_{33} \end{bmatrix}$$

Figures 4-6 show the results for Uganda, Kenya and Tanzania. Table 2 shows the coefficient estimates for the B matrix, and Table 3 shows variance decompositions implied by the structural VAR.

The impulse responses are generally quite similar to the ones implied by the Choleski factorization. There is one noticeable difference, however, which is that the responses to *dNDA* are somewhat larger for all four countries when estimated using the structural VAR. The SVAR therefore seems to be somewhat better at picking up short-run pressures coming from capital mobility.

Fig 4 *UGANDA impulse responses (structural VAR)*

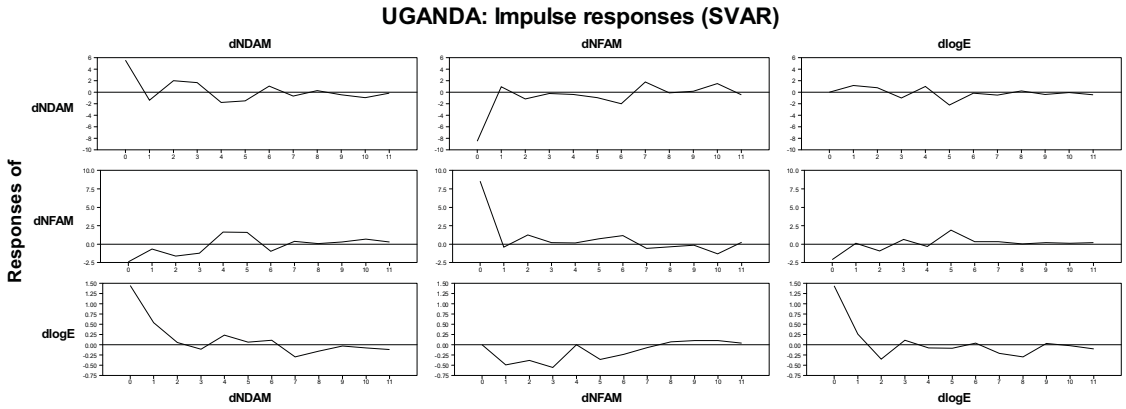


Fig 5 *KENYA impulse responses (structural VAR)*

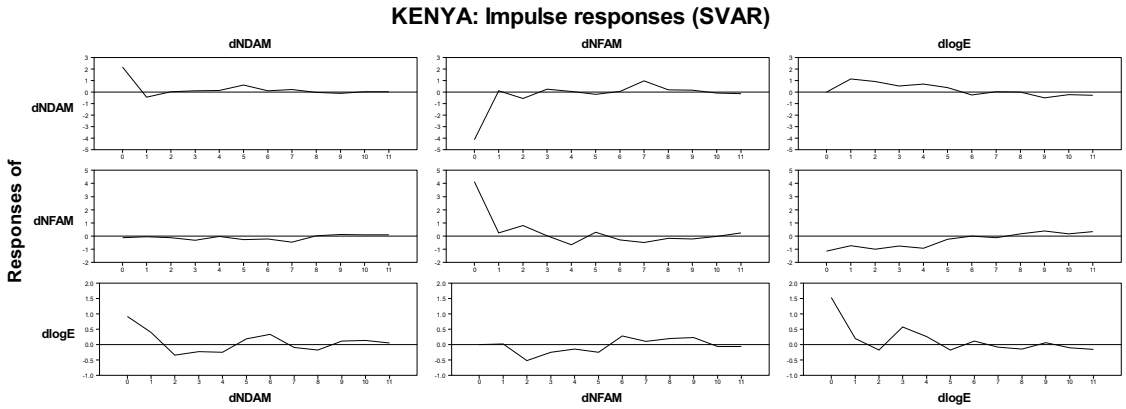


Fig 6 *TANZANIA impulse responses (structural VAR)*

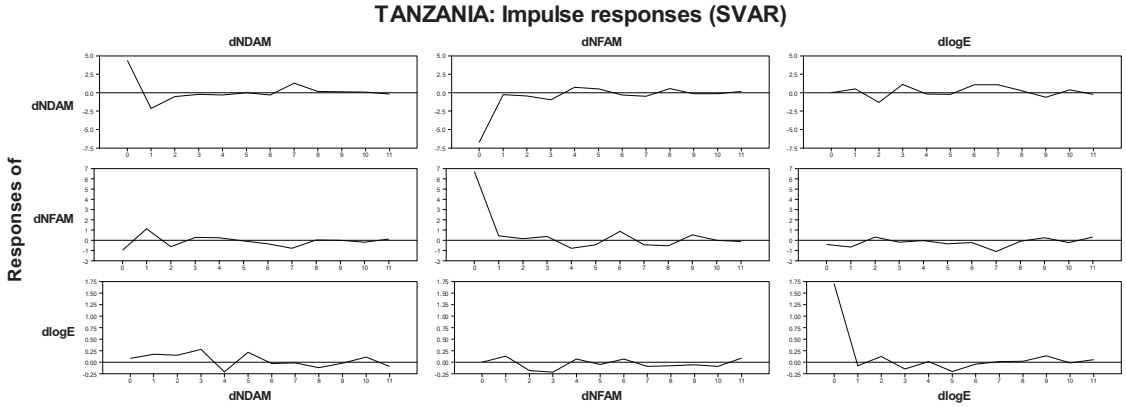
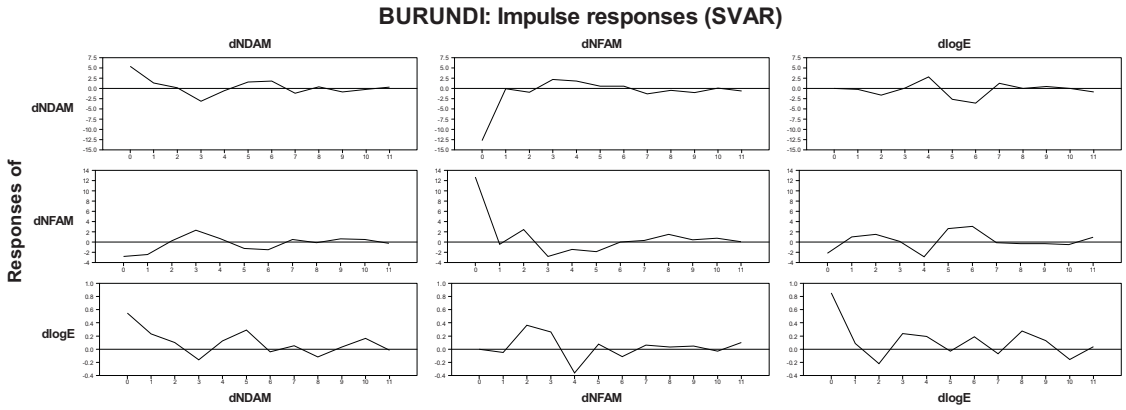


Fig 6a *BURUNDI impulse responses (structural VAR)*



The diagonals of the *B* matrix indicate the variances of the underlying orthogonal shocks. From Table 1, the rankings are as follows:

Table 1a *Variances of structural shocks*

Shock	*Ranking from largest to smallest*
Sterilized shocks to NFA	Burundi > Uganda > Tanzania > Kenya
Non-aid shocks to the BoP	[Tanzania >≈ Kenya >≈ Uganda] >Burundi
Shocks to monetary policy	[Uganda >≈ Burundi >≈ Tanzania] > Kenya

[Square brackets indicate shocks of roughly similar size]

The sizes of sterilized shocks to NFA may be roughly consistent with the ranking of these countries by aid dependence; Kenya is certainly by far the least aid-dependent. The small size of non-aid shocks to the BoP in Burundi may reflect that country's very small export base and low degree of capital mobility. In terms of shocks to monetary policy, the relative stability of net domestic assets in Kenya may reflect the less intensive use of balance sheet instruments in that country, by comparison with policy interest rates; and possibly its greater degree of financial development.

Table 2 *Coefficient estimates for the B matrix*

Coefficient	**Uganda**	**Kenya**	**Tanzania**	**Burundi**
b_{11}	5.54 (6.05***)	2.15 (5.16***)	4.37 (5.9***)	5.36 (3.43***)
b_{21}	-2.41 (-2.50***)	-0.13 (-0.29)	-0.96 (-1.4)	-2.78 (-1.67*)
b_{22}	8.53 (14.42***)	4.14 (14.90***)	6.74 (14.4***)	12.73 (11.82***)
b_{23}	-2.08 (-4.18***)	-1.14 (-2.89***)	-0.39 (-0.8)	-2.20 (-2.94***)
b_{31}	1.45 (5.22***)	0.92 (2.72***)	0.08 (0.31)	0.55 (2.08**)
b_{33}	1.43 (5.78***)	1.53 (7.49***)	1.70 (14.40***)	0.85 (4.99***)

Asterixes denote significance at the * = 10%, ** = 5%, *** = 1% levels. Note: the B matrix is identified up to sign changes along one or more of the columns. We have chosen the normalization that produces positive diagonals.

Table 3 shows forecast error variance decompositions based on the structural VARs. Shocks to net foreign assets explain 60 percent or more of the forecast error in net domestic assets in all four countries. This is consistent with the high degree of contemporaneous sterilization observed in all countries. The shocks being sterilized might be associated with foreign exchange intervention by the central bank, but they may also reflect the prevalence of self-sterilizing transactions between the central bank and the rest of the public sector. Such transactions would include the use of domestic-currency government deposits to purchase imports or the receipt of aid money by a government ministry which then deposits it in the central bank. The responses of *dNFA* and *dlogE* to shocks to net domestic assets provide some evidence on how domestic liquidity conditions feed into the balance of payments. The impacts appear to be largest overall in Uganda, consistent with the openness of its capital account. The smallest overall are perhaps in Tanzania, although the offset through net foreign assets is virtually zero in Kenya, where pressures appear almost entirely in the exchange rate.

Table 3 *Variance decompositions from the structural VARs (12 month horizon)*

Country and variable	*Contribution of row variable to forecast error variance in:*		
	dNDA	*dNFA*	*dlogE*
Uganda			
dNDA	33.3	16.4	43.9
dNFA	60.0	74.4	15.5
dlogE	6.7	9.2	40.7
Kenya			
dNDA	19.3	2.1	29.1
dNFA	68.0	78.7	12.2
dlogE	12.7	19.2	58.7
Tanzania			
dNDA	32.3	6.6	7.6
dNFA	60.0	89.2	4.1
dlogE	7.9	4.2	88.3
Burundi			
dNDA	18.8	10.0	27.6
dNFA	68.1	75.9	19.0
dlogE	13.0	14.1	53.5

4. Characterizing offset behavior

The variance decompositions provide one type of evidence on the degree of short-run capital mobility, by showing the influence of monetary policy shocks on forecast errors in reserves and exchange rate depreciation. A second kind of evidence comes from the direction and magnitude of the impulse responses of these variables to monetary policy shocks. Table 4 compares the cumulative impulse responses in the 4 countries using the SVAR results. To make the results comparable, we choose a shock equal to 1 percent of the monetary base in each country. Figures 7a – 7c show the impulse responses for the first year following the shock.

Table 4 *Cumulative impulse responses to a one-unit shock to dNDA*

	Response of *NFA*				Response of *logE*			
	0	*1*	*3*	*12*	*0*	*1*	*3*	*12*
Uganda	*-0.44*	*-0.56*	*-1.08*	*-0.43*	*0.26*	*0.26*	*0.35*	*0.30*
Kenya	*-0.06*	*-0.08*	*-0.28*	*-0.58*	*0.43*	*0.61*	*-0.34*	*0.46*
Tanzania	*-0.22*	*0.04*	*-0.03*	*-0.24*	*0.02*	*0.06*	*0.16*	*0.13*
Burundi	-0.52	*-0.98*	*-0.49*	*-0.51*	*0.10*	*0.15*	*0.13*	*0.23*

Note: A one-unit shock to *dNFAM* or *dNDAM* is a shock equal to one percent of the lagged value of the monetary base. A one-unit shock to *dlogE* is a depreciation of one percent.

Figure 7a

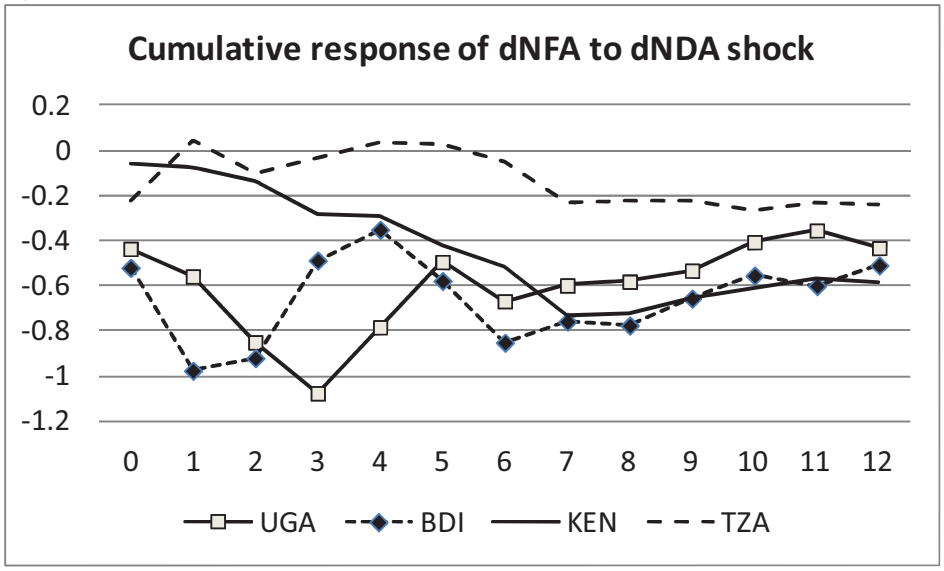


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Figure 7b

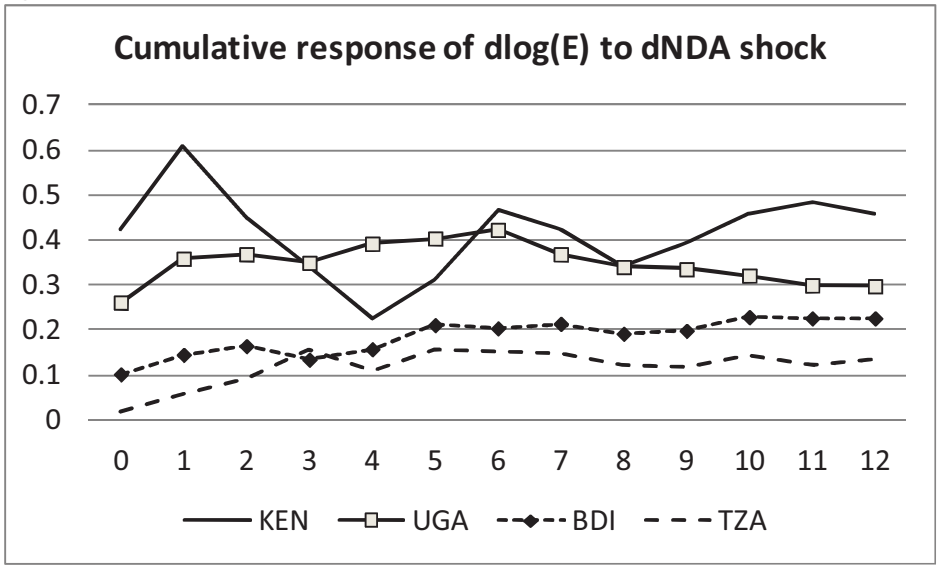

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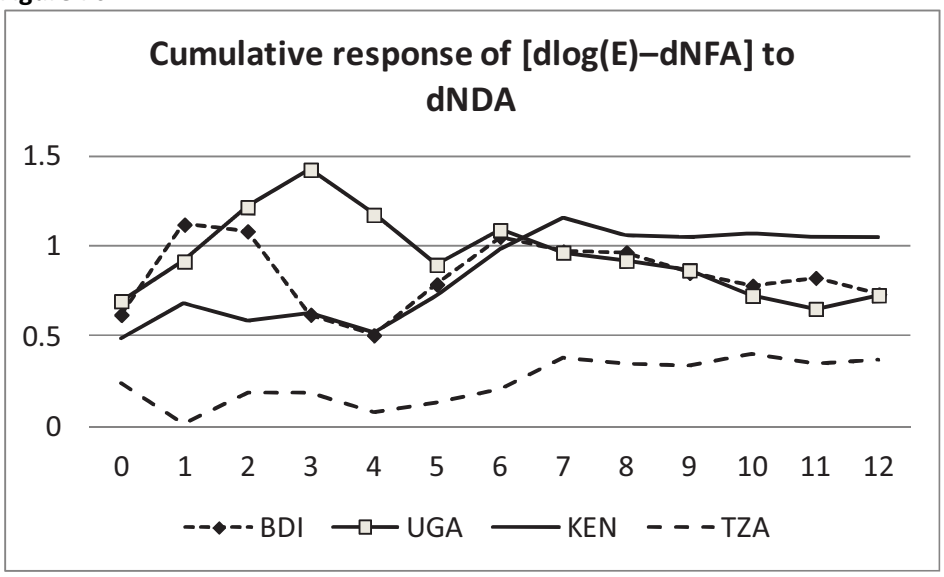
Figure 7c



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5. Conclusions

The statistical significance of our findings is generally weak, a challenge that will be difficult to overcome in stationary VARs using a decade of data. The signs of the impulse responses nonetheless accord with theoretical expectations in all five countries. With respect to our central question – the effect of monetary policy shocks on the balance of payments – the point estimates suggest a fairly strong response of portfolio behavior to monetary policy shocks over the course of a few months, though Tanzania is an exception. Central banks absorb these pressures through a combination of exchange rate depreciation and reserve losses, consistent with their observed exchange rate behavior over the sample

period. The evidence suggests that capital mobility is imperfect, but that especially in Kenya and Uganda it may already constitute a serious constraint on monetary policy in the EAC.

Appendix 1
Sterilization and Offset Behavior in an Aid-Dependent Economy: A Structural VAR approach

Let u be the vector of reduced-form innovations from a 3-variable VAR in $[dNFAM, dNDAM, dlogE]$. Let ε be the vector of mutually orthogonal structural innovations with $u = B\varepsilon$. The estimated covariance matrix for u (along with normalization) gives us six nonlinear restrictions on the elements of B. We need 3 more restrictions to just-identify B.

We start by positing unobserved aid shocks. These shocks come from the receipt or spending of aid, and we assume they are always self-sterilized. In other words, when aid arrives, there are equal and offsetting changes in domestic credit and reserves, leaving the monetary base unchanged; and when aid is spent (whether on traded goods or not) the spending is fully sterilized through foreign exchange sales either to the public or private sectors, again leaving the monetary base unchanged. This generates a cross-equation restriction between the domestic credit and reserves equations.

A structure that incorporates this restriction, along with some others, is:

$$u_D = \varepsilon_D - \varepsilon_A$$
$$u_R = -\alpha\varepsilon_D + \varepsilon_A + \beta\varepsilon_B$$
$$u_E = \gamma\varepsilon_D - (1-\beta)\varepsilon_B$$

where u_D, u_R and u_E are reduced-form shocks to the three variables in the VAR and where ε_D, ε_A and ε_B are mutually orthogonal structural shocks to domestic credit, aid or aid-financed domestic spending, and the non-aid balance of payments. There are some additional restrictions here, in addition to the restriction that ε_A enters with equal and opposite coefficients. The non-aid balance of payments shock is assumed not to affect domestic credit contemporaneously, and the aid shock is assumed not to affect the exchange rate; and the non-aid balance of payments shock is a shock to the sum of $-u_R$ and u_E (i.e., ε_B is an 'exchange market pressure' shock).

This takes the form $u = B\varepsilon$, with only 3 free parameters in the *B* matrix. But if we estimate in this form we can't normalize the structural shocks to have unit variances. Alternatively we can normalize the structural shocks to unit variances and allow the diagonals of *B* to be estimated. This gives

$$B = \begin{bmatrix} b_{11} & -b_{22} & 0 \\ b_{21} & b_{22} & 1+b_{33} \\ b_{31} & 0 & b_{33} \end{bmatrix}$$

In terms of interpreting the results:

- Impulse responses to domestic credit should tell us something about whether short-term capital mobility is a serious constraint on monetary policy, operating either through reserves or through the exchange rate.

- The size of b_{33} should tell us about de facto flexibility of the exchange rate.

- The sizes of b_{22} and b_{23} give us estimates of the variances of the aid and non-aid balance of payments shocks. These magnitudes, and the variance decompositions, should tell us

something about the relative importance of self-sterilizing and non -self-sterilizing shocks to the balance of payments.

Note that the system appears is over-identified, because we have 4 restrictions and need only three. This gives us the option of relaxing one of the zero restrictions or one of the cross-equation restrictions.

Neither of the zero restrictions is theoretically grounded. In the domestic credit equation, $b_{13} = 0$ says that non-aid balance of payments shocks are allowed to feed through to the monetary base, because there is no offset via reductions in domestic credit. Since we are modeling a money-base program, it might be more realistic to allow partial sterilization (b_{31}/b_{32} would estimate the degree of contemporaneous sterilization of reserve movements that arise from non-aid balance of payments shocks). In the exchange rate equation, $b_{32} = 0$ says that aid and aid-spending shocks do not affect the exchange rate contemporaneously; this is a tight restriction if the private sector observes aid contemporaneously. Of these two, the more natural one to drop is probably $b_{13} = 0$.

Of the two cross-equation restrictions, the more natural one to drop is $b_{23} = 1 + b_{33}$; note that we have already allowed $b_{21} \neq 1 + b_{31}$). The self-sterilizing nature of aid flows is critical to the whole approach so we would want to retain $b_{12} = -b_{22}$.

Appendix 2
Adjusting Central Bank Balance Sheet Data for Exchange-Rate Valuation Effects

1. Accounting in theory

Net foreign assets at the end of period t are given by

$$NFA_t = E_t \cdot R_t^{\$} \tag{A2.1}$$

Where E_t is the end-of-period exchange rate in local currency per USD and $R_t^{\$}$ is the end-of-period value of net foreign assets in USD. The change in net foreign assets from this period to the next is therefore given by

$$\Delta NFA_{t+1} \equiv NFA_{t+1} - NFA_t = \int_t^{t+1} \left[\frac{d(E_s \cdot R_s^{\$})}{ds}\right] ds = \int_t^{t+1} \left[E_s \cdot \frac{dR_s^{\$}}{ds}\right] ds + \int_t^{t+1} \left[R_s^{\$} \cdot \frac{dE_s}{ds}\right] ds. \tag{A2.2}$$

The two parts of ΔNFA_{t+1} reflect net purchases or sales of foreign assets, on the one hand, and valuation changes, on the other. Only the first of these affects the monetary base. To approximate this first term, we make two assumptions about how net foreign assets (in dollars) and the exchange rate evolve over the interval from t to $t+1$:

- $dR_t^{\$}/ds = \alpha$ for $s \in [t, t+1]$ where $\alpha = R_{t+1}^{\$} - R_t^{\$}$. (A2.3a)
- $dlog(E_s)/ds = \beta$ for $s \in [t, t+1]$ where $\beta = \log(\mathrm{E_{t+1}}/\mathrm{E_t})$. (A2.3b)

The second of these implies that for $s \in [t, t+1]$ the exchange rate follows the process

$$E_s = E_t \cdot e^{\beta(s-t)}. \tag{A2.4}$$

The change in the monetary base due to reserve transactions is therefore given by

$$\int_t^{t+1} \left[E_s \cdot \frac{dR_s^{\$}}{ds}\right] ds = \alpha E_t \int_t^{t+1} e^{\beta(s-t)} ds = \alpha E_t \int_0^1 e^{\beta s} ds. \tag{A2.5}$$

The final integral equals $\beta^{-1}(e^{\beta} - 1)$, which in turn equals $z_{t+1}/\log(1 + z_{t+1})$ where z_{t+1} is the observed rate of depreciation between periods t and $t+1$. Using (3a) and (3b), the change in the monetary base due to net foreign exchange transactions can therefore be approximated by

$$\int_t^{t+1} \left[E_s \cdot \frac{dR_s^{\$}}{ds}\right] ds = E_t \Delta R_{t+1}^{\$} \frac{z_{t+1}}{\log(1+z_{t+1})}. \tag{A2.6}$$

The correction term $z_{t+1}/\log(1 + z_{t+1})$ is above 1 when z_{t+1} is positive and below 1 when z_{t+1} is negative. To calculate (6) we only need to know the change in dollar net foreign assets and the cumulative percentage depreciation over the period.

2. Accounting in practice

A central bank balance sheet looks like this:

Assets	**Liabilities**
Net foreign assets	*Monetary Base*
Domestic credit	Currency outside banks
To government	Bank reserves
To banks	Vault cash
To private sector	Bank deposits
	Government Deposits
	Own Securities Outstanding
	Net Worth
	Capital and Reserves
	Other items net

Since the identity

$$\text{Monetary Base} = \text{Net Foreign Assets} + \text{Net Domestic Asset} \tag{A2.7}$$

holds, net domestic assets are defined implicitly as

$$\text{NDA} = \text{DC} - \text{Government Deposits} - \text{Own Securities Outstanding} - \text{NW}. \tag{A2.8}$$

Valuation changes in net foreign assets are absorbed on the right-hand side of (7) via equal and opposite changes in NFA and Net Worth.

For purposes of studying central bank behavior, we need to purge both NFA and NDA of valuation changes. From (6), the change from one period to the next in the modified value of net foreign assets is

$$\Delta NFAM_{t+1} = E_t \Delta R^{\$}_{t+1} \frac{z_{t+1}}{\log(1+z_{t+1})}. \tag{A2.9}$$

which can be calculated directly if we have data on the USD value of net foreign assets. If we only have data on domestic-currency net foreign assets, we can use the identity $NFA_t = E_t \cdot R^{\$}_t$ to obtain

$$\Delta NFAM_{t+1} = \left(\frac{NFA_{t+1}}{1+z_{t+1}} - NFA_t\right) \frac{z_{t+1}}{\log(1+z_{t+1})}. \tag{A2.10}$$

Either way, the change in modified net domestic assets can then be calculated as a residual:

$$\Delta NDAM_{t+1} = \Delta MB_{t+1} - \Delta NFAM_{t+1}. \tag{A2.11}$$