DRAFT

TAX REVENUE AND (OR?) TRADE LIBERALIZATION

Thomas Baunsgaard and Michael Keen*

This version: September 20, 2004

Abstract: With the public finances of many developing and emerging market countries still heavily dependent on trade tax revenues, further trade liberalization may be stymied unless they are able to develop alternative sources of revenue. While there is now a well-established body of theory and policy advice on how this might be done in principle, this paper asks what has happened in practice: Have countries in fact recovered from other sources the revenues they have lost from past episodes of trade liberalization? Using panel data—cleaned for a variety of weaknesses in the standard data sources—covering 125 countries over the period 1975–2000, the answers that emerge are both fairly robust and troubling: high income countries have recovered revenues with ease, but middle income countries have recovered only about 35–55 cents for each dollar of trade tax revenue they have lost. Still more troubling, low income countries have recovered essentially none. Nor is there much evidence that the presence of a VAT has in itself made it easier to cope with the revenue effects of trade liberalization.

Acknowledgements: We are grateful to Laura Clauser and other seminar participants for helpful comments. Views and errors are ours alone, and should not be attributed to the International Monetary Fund.

* Fiscal Affairs Department, International Monetary Fund, Washington D.C., 20431 (*email* tbaunsgaard@imf.org and mkeen@imf.org)

I. INTRODUCTION

Despite significant trade liberalization in recent years, many developing and emerging market economies continue to rely heavily on trade taxes as a source of revenue: in Sub-Saharan Africa, for instance, trade taxes account for an average of about one-third of all government revenues, in the developing countries of Asia and the Pacific they account for around 15 percent.[1] A primary concern for many countries as they contemplate further liberalization—whether in the context of proliferating regional agreements, bilateral agreements with the EU or other developed countries, or in relation to prospective multilateral tariff reduction under the Doha round—is thus the potential impact on public revenues. Indeed, this dependence on trade tax revenues is emerging ever more clearly as a potentially significant obstacle to further trade liberalization.

In the early stages of liberalization, the revenue consequences of reform may be relatively minor. Indeed the first steps of trade policy reform—often involving the reduction of prohibitively high tariffs, tariffication of quotas, and raising of low tariff rates in moving towards a more uniform tariff—may plausibly lead to an increase in trade tax revenues (as discussed and documented by Ebrill et al (1999)). There must come a point, however, at which further movement towards freer trade reduces trade tax revenues. The question then is whether such revenue losses can be recouped from the domestic tax system. In theory, it is easy to do so, most obviously by strengthening domestic indirect taxes, and there is now a fairly extensive theoretical literature on this: Keen and Ligthart (2001), for example, show that a strategy of increasing domestic consumption taxes (slightly less than) one-for-one with tariff cuts leaves consumers better off (because the consumer price falls), preserves the production efficiency gain from the tariff reform, and increases the government's revenue (since consumption is a wider tax base than imports).[2]

What is easy in principle, however, is not always easy in practice; in particular, the well-known relative administrative ease of collecting customs duties may mean that replacement from other sources requires significant reform of wider tax practices. The purpose of this paper is thus to address the empirical question of whether, in practice, countries have indeed been able to make good from other sources any loss of revenue from trade taxes that they have experienced. Put (over-)simply, we ask: for each $1 of trade tax revenue that they lose, how many dollars have they, in fact, tended to recover from other sources?

Surprisingly, this question seems to have received virtually no attention. Both Ebrill et al (1999) and Khattry and Rao (2002) focus instead on the question of how trade tax revenues are affected by trade liberalization, and on identifying (arguably something of a chimera) a

[1] Keen and Simone (2004).

[2] There are important caveats to this basic argument, some of which are pursued in Keen and Ligthart (2001, 2003). Hatzipanayotou, Michael, and Miller (1994) and Michael, Hatzipanayotou, and Miller (1993) consider infinitesimal shifts from trade to domestic commodity taxation.

revenue-maximizing tariff rate, beyond which trade tax revenues fall with further tariff cuts, while Abgeyegbe, Stotsky and Woldemariam (2004) examine the links between trade liberalization and trade tax revenues in Sub-Saharan Africa. The concern here, however, is quite different. It is not with the impact of trade liberalization—measured, say as a reduction in average collected tariff rates—on trade tax revenues, but with the links between trade tax revenues and total revenues: measures of trade liberalization that do not affect trade tax revenues simply do not set off the scope for adjustment in other revenues that is the starting point of our concern.[3] Khattry and Rao (2002) do consider the extent to which trade tax revenues have been replaced from other sources, but do so only in the form of tabulations. These lead them to somewhat pessimistic conclusions as to the extent to which trade tax revenues have indeed been recovered, especially in low income countries—but these conclusions, being based on simple correlations, might simply reflect a failure to condition on changes in other variables tending to be associated with lower tax revenues from other sources.

There thus appears to have been no formal econometric assessment of the extent to which countries have in fact succeeded in offsetting reductions in trade tax revenues by increasing revenues from other sources. It is this that the present paper seeks to do, examining experience in a large panel of countries.

One of the reasons that empirical work in this area has remained so limited appears to be the relative paucity of reliable data on trade tax revenues in developing countries. To overcome this obstacle, we have assembled and use here what we believe to be a reasonably reliable and broad data set comprising 125 countries, and covering the period 1975 to 2000.[4] The essence of the empirical strategy is then to examine the relationship between total tax revenues and revenue from trade taxes alone, with the two ultimately being independent of one another if countries are able to replace lost trade tax revenues from other sources. Section II describes these data in more detail, and takes a first look at their main features. The conceptual framework for the estimation is set in Section III. Empirical results are in Section IV, and section V concludes.

II. DATA

Outside the OECD countries, data on tax revenues in general—and trade tax revenues in particular—are not as readily available as one might expect. The *Government Finance Statistics* (GFS) produced by the IMF suffer from a number of well-known difficulties: the series has many gaps, including missing variables or simply no entries for a particular

[3] Thus when we speak somewhat loosely below of the trade revenues lost from trade liberalization this is not to imply that trade liberalization always means such revenue losses, but rather that it is only when it does lead to such revenue losses (or conceivably gains) that the issue with which we are concerned arises.

[4] Khattry and Rao (2002) use raw GFS data, covering a longer period (1970 to 1998) and fewer countries (80).

country, and typically relates only to central government revenues.[5] Moreover—and of particular importance in the present context—what is recorded as trade tax revenue in many cases, especially in Africa, appears to include VAT and other sales tax collected at the border: thus trade tax reforms that reduce tariff revenue but are offset by an increase in sales tax revenue would go unnoticed. To address these problems, we have taken the GFS data as starting point, but also made use of revenue information provided in the context of the IMF's periodic "Article IV" consultations with member countries. The Article IV data is generally regarded as more reliable, and has been used whenever they conflict with the *GFS* (not an infrequent occurrence). We have also made a particular effort to ensure that 'trade tax' revenue does not include revenue from other taxes collected at the border. In this way we arrive at an unbalanced panel of 125 countries for the period 1975–2000.

The basic empirical strategy in our analysis is to examine the relationship between countries total tax revenue from all sources (including trade taxes) and their revenue from trade taxes alone (both relative to GDP). To the extent that countries are able (and choose) to recoup any revenue lost from trade liberalization, the two should be unrelated—at least over a long enough period of time to allow for possible lags in this recovery. Figures 1 and 2 report basic features of the sample bearing on this.

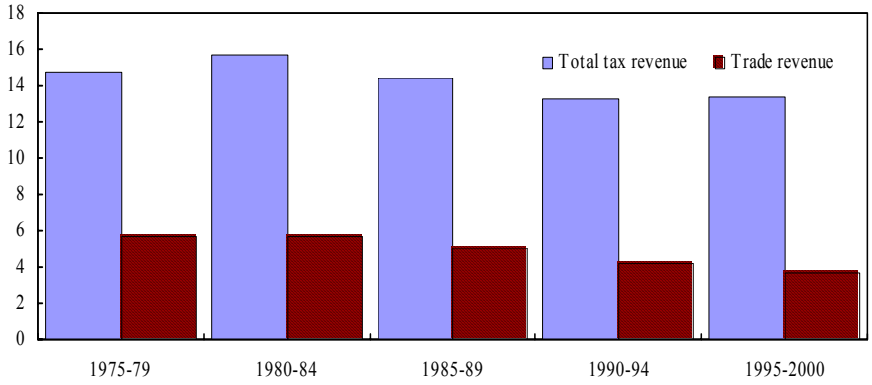
Figure 1 reports the five-year averages of total and trade tax revenue (relative to GDP) for the sub-groups of the sample comprising 41 low-, 56 middle- and 28 high-income countries (these being defined by the World Bank classification).[6] Experience clearly varies widely across the income groups. For the high income countries, shown in the last panel, the slight reduction in trade tax revenues (which start the sample period at a very low level) coincides with a sustained increase in total tax revenues. For low income countries, in contrast, a steady reduction in trade tax revenues over the last twenty years has been accompanied by a trend reduction in total revenues—with a clear suggestion that in fact lost trade tax revenues have not been fully recovered from other sources. In the middle income group, total and trade tax revenues seem to have moved, modestly, in opposite directions: over the last twenty years, total revenues have, on average, increased despite a slight reduction in trade tax revenues.

[5] There is a potential source of bias in our empirical strategy in this, through the possibility that reductions in trade tax revenue (almost always allocated to the central government) might be offset by increased revenues at lower levels of government (not recorded in our data for total revenues)—in which case recovery from losses of trade tax revenues would go unremarked. It seems unlikely that this is a serious problem for the approach here, however, since the most obvious instruments for the replacement of trade tax revenues—most notably general sales taxation—are commonly also allocated primarily to central government. The underlying policy issue is, nevertheless, an important one in a number of countries. Rajaraman (2004) stresses, for instance, the obstacle to trade liberalization in India created by the allocation of trade taxes to the central government, but of broad based sales taxation to the states. Replacing trade tax revenues whilst leaving spending responsibilities unchanged would thus require an adjustment of vertical transfers.

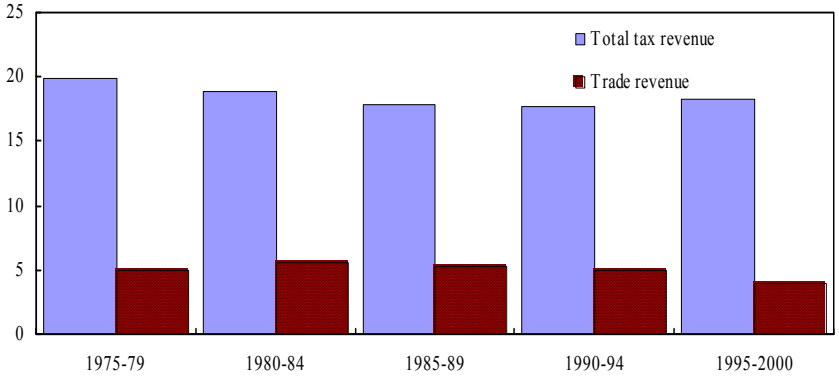
[6] Classified by their income position at the end of the sample period.

Figure 1. Average Tax Collections, 1975–2000

(ii) Low-income countries



(iii) Middle-income countries



(iv) High-income countries

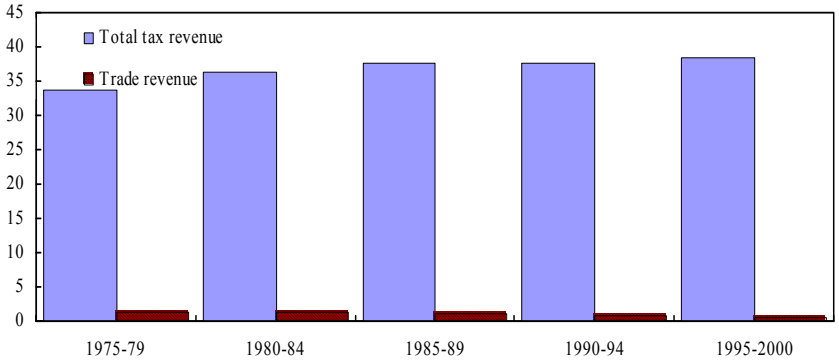
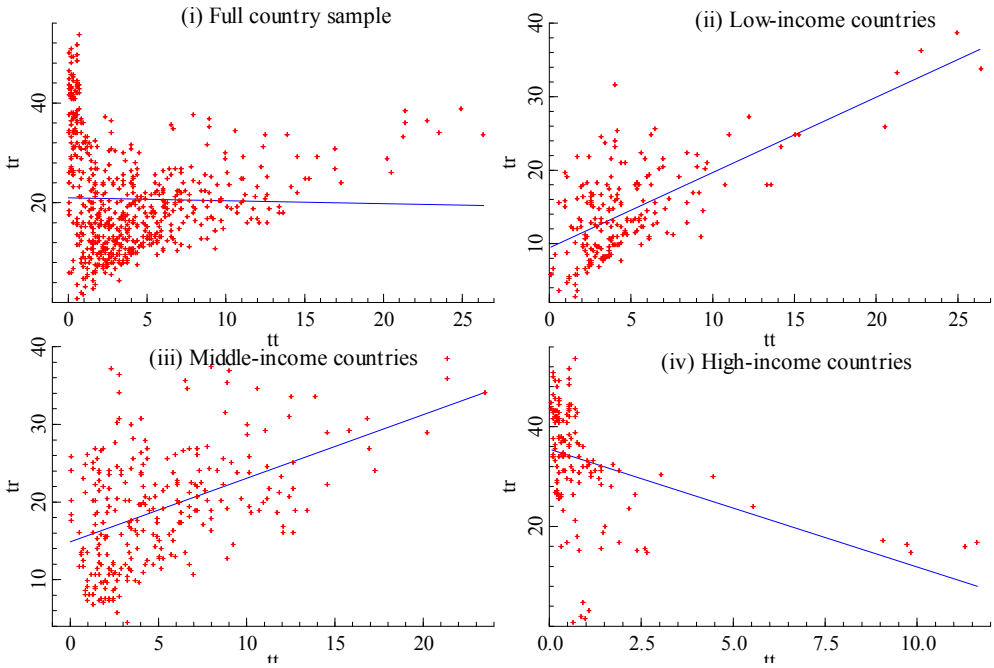


Figure 2. Total Tax Revenue and Trade Tax Revenue, 5-year Averages, 1975-2000



The data points underlying these averages are presented as scatters of total tax revenue (tr) against trade tax revenue (tt) in Figure 2, each dot representing a five-year average for a some country. The simple regression lines tend to confirm the impressions from Figure 1, but also show considerable heterogeneity and so point to the need to control for other factors affecting the relationship between total and trade tax revenues. It is to this that we now turn.

III. EMPIRICAL SPECIFICATION

Some simple analytics are useful for further understanding the issues and guiding the empirics. Consider then a country which raises revenue from two sources: trade taxes, in amount R^T, and non-trade taxes, R^N. Its welfare is of the form

$$W(R,X) - \left(\frac{1}{2}\right)\delta^T(X)(R^T)^2 - \left(\frac{1}{2}\right)\delta^N(X)(R^N)^2 \qquad (1)$$

where the function $W(\cdot)$, indicates the welfare derived from public expenditure $R \equiv R^N + R^T$ and (perhaps in reduced form rather than directly) from a vector X of country-specific conditioning variables, while the terms $\delta^i(R^i)^2$ reflect the efficiency, administration

and compliance costs associated with the two forms of taxation (which we shall refer to simply as their costliness). If unconstrained, the country would set the underlying tax instruments so that revenues from the two sources satisfy the necessary conditions:

$$W_R(R,X) - \delta^i(X)R^i = 0, \qquad i = T, N, \tag{2}$$

where the subscript indicates a partial derivative, and the second order condition is satisfied so long as $W(\cdot)$ is concave in *R*. Combining the two conditions gives the simple rule:

$$\frac{R^T}{R} = \frac{\delta^N(X)}{\delta^T(X) + \delta^N(X)} \tag{3}$$

so that the proportion of total revenue raised from each source reflects its relative costliness.

A simple way to conceptualize trade liberalization in this context is as an exogenous change in underling trade tax instruments—dictated perhaps by participation in regional or multilateral negotiations—and hence in the associated revenue. Taking R^T as parametric in the necessary condition (2) for the choice of non-trade revenues, one finds that

$$\frac{dR^N}{dR^T} = \frac{W_{RR}(R,X)}{W_{RR}(R,X) - \delta^N(X)} \tag{4}$$

and hence that reoptimization of non-trade revenues in the face of trade liberalization implies a change in *total* revenues of[7]

$$\frac{dR}{dR^T} = -\left(\frac{\delta^N(X)}{\delta^N(X) - W_{RR}(R,X)}\right) \in [-1,0] \tag{5}$$

The extent to which a country optimally replaces lost trade tax revenues from other sources thus depends, in this highly stylized framework, on two considerations. The first is the costliness of raising revenue from those alternative sources: what matters, note, is not the ease of collecting customs revenue, but the difficulty of collecting anything else. But collection costs (broadly interpreted to include also deadweight losses) are not all that matter. The second consideration is the rapidity with which the marginal value of public expenditure increases as the level of expenditure falls: intuitively, the impact effect of the loss of trade tax revenue is a reduction in public expenditure—and the greater the increase in the marginal value of pubic expenditure to which this leads the greater is the tendency to recover revenue from other sources.

---

[7] Note that the first-order condition for R^T is not used in deriving (4), which thus applies even when the initial level of trade taxes is not chosen optimally.

Overall, it is also worth stressing, total revenue unambiguously falls.[8] Intuitively, by constraining the way in which revenue can be raised trade liberalization increases the minimized cost of raising any amount of revenue, and hence results in less being raised.

We take (4) as the basis of our estimation, taking the dependent variable to be revenues from sources other than trade taxes. To allow for plausible dynamics in policy adjustment, we also include a lagged dependent variable (there being significant serial correlation in its absence). The specifications we consider are thus of the for

$$R_{it}^N = \alpha_i + \beta_0 R_{i,t-1}^N + \beta_1 R_{it}^T + \beta_2 X_{it}^T + \beta_3 V_{it} R_{it}^T + \mu_t + \varepsilon_{it} \quad (6)$$

where *i* and *t* are respectively country- and time-indicators, and—for simplicity in interpreting the results (and because they in any event generally prove insignificant)—we omit interactions between X and R^T, other than that between trade tax revenue and a dummy variable V_{it} taking the value unity if country *i* has a VAT at time *t* and zero otherwise.

Leaving aside any distinct effect of the VAT, the extent to which a country ultimately compensates from domestic revenues for a reduction in trade taxes is conveniently described by $\theta \equiv -\beta_1/(1-\beta_0)$. If $\theta = 1$, recovery is ultimately complete, with total revenue being unaffected by the loss of trade tax revenue; at the opposite extreme, if $\theta = 0$ then any loss of trade tax revenue implies an ultimate reduction of total revenues of exactly the same amount. The sign of β_3 is also of interest in its own right., since a standard policy prescription for countries faced with reduced trade taxes is to strengthen or introduce a broad-based domestic consumption tax, with the VAT generally the recommended form: finding a negative β_3 would tend to corroborate this advice, indicating that countries with a VAT cope better with the revenue losses form trade liberalization that do those without.

Candidates for inclusion in X are variables that may affect either the valuation of public expenditure or the costliness of raising revenue other than by trade taxes. Drawing on the extensive empirical literature that models the share of total tax revenues in GDP (see, in particular, Rodrik (1998) and Tanzi (1987)), we take these to include: GDP per capita, traditionally regarded as affecting the demand for public expenditure, and also perhaps proxying administrative capacity; openness (measured as the share of imports and exports in GDP), and robustly found to be positively associated with the size of government; inflation, an important phenomenon, and in many cases an important source of revenue, in much of our sample period; aid per capita (expected to reduce the incentive for a country to raise revenue from its own taxes), and; the share of agriculture in GDP, reflecting the extent of an especially hard-to-tax sector. Data definitions and sources are set out in Appendix 1.

---

[8] Except in the extreme case in which $\delta^N = 0$; but then trade taxes need not optimally not be used at all.

In assessing the revenue impact of trade reform, it should be emphasized, we take no account of potential indirect effects through the *X* regressors. For example, trade liberalization may not only reduce trade tax revenues but also lead to an increase in GDP[9]—indeed that may be one reason for undertaking the liberalization—with that increase in income in turn being associated with a higher level of revenue from taxes other than those on trade. Similarly, by expanding the volume of imports and exports trade liberalization may also increase openness, which as will be seen is strongly associated in our sample with revenue other than from trade taxes. In such ways, trade liberalization may to some degree pay for itself. Modeling these indirect revenue effects would require analyzing the links between these variables and the instruments of trade reform. We do not address these links here, however, but focus on what seems to be the wisest way to pose the policy problem: since growth and other such indirect sources of revenue gain are inherently uncertain, countries considering foregoing trade tax revenue as part of a process of trade liberalization would be well-advised to ask whether they can recover those revenues from other sources even without relying on growth or other such effects of the reform. That is the question to which the empirics are addressed.

IV. RESULTS

Results for the full sample are shown in Table 1.[10] The first column reports a fixed effects specification. The coefficients mostly enter with the expected signs, showing revenue other than from trade taxes to increase with income per capita and the openness of the economy, and to decrease with the level of aid. On the question of central interest, there is evidence (in the significantly negative estimate of β_1) of some recovery from trade tax losses. The coefficient on the interaction between trade taxes and the VAT dummy indicates, however, that this recovery is no greater in countries with a VAT than in those without. Taking account of the lagged dependent variable, the implied point estimate of θ—reported in these tables only when the underlying coefficients are significant at 10 percent or better—is 0.286. That is, other revenues increase by only about 30 cents for each $1 of trade tax revenue that is lost; conversely, a $1 loss of trade tax revenue is ultimately associated with a reduction in total tax revenues of about 70 cents. The incompleteness of the recovery from lost trade taxes is striking.

The second column reports a random effects specification. The trade tax variables are in this case insignificant, and the specification also perhaps less plausible in the insignificance of openness and the significant but positive relation between the share of agriculture and non-

[9] The links between trade liberalization, openness and growth remain controversial, of course: see for instance Wacziarg and Welch (2003).

[10] Time dummies are not included in the regressions reported in Tables 1-4. These prove almost entirely insignificant, reducing the precision of the estimates without affecting the broad conclusions derived.

Table 1. Full sample, 1975-2000 1/

	Dependent variable: Non -trade tax revenue				
	(1) FE	(2) RE	(3) IV	(4) GMM (one step) 2/	(5) GMM (two step) 2/
Lagged nontrade revenue	0.720**	0.975**	0.719**	0.515**	0.530**
	(0.016)	(0.006)	(0.016)	(0.050)	(0.008)
Trade tax to GDP	-0.080**	-0.027	-0.078**	-0.185**	–0.171**
	(0.040)	(0.039)	(0.034)	(0.089)	(0.017)
Lagged trade tax to GDP	0.002	0.042			
	(0.039)	(0.039)			
Trade tax×VAT dummy	0.037	0.021	-0.020	0.005	–0.060*
	(0.038)	(0.026)	(0.047)	(0.117)	(0.035)
Log per capita GDP	0.495*	0.343**	0.500*	2.137**	2.113**
	(0.295)	(0.067)	(0.296)	(1.007)	(0.376)
Openness	0.010**	0.001	0.010**	0.020**	0.020**
	(0.003)	(0.001)	(0.003)	(0.004)	(0.001)
Log inflation	0.014	0.092**	0.013	0.154*	0.143**
	(0.049)	(0.038)	(0.049)	(0.082)	(0.011)
Aid per capita	-0.004**	0.000	-0.004**	-0.003	–0.002**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.0002)
Share of agriculture	-0.015	0.018**	-0.017	-0.014	–0.009**
	(0.013)	(0.006)	(0.013)	(0.032)	(0.004)
Implied theta 3/	0.286		0.278	0.381	0.491
R^2	0.969	0.975	0.969		
Hausman 4/		335.9** (9)			
m_1 5/				–4.70** (0.000)	–4.40** (0.000)
m_2 5/				0.23 (0.821)	0.27 (0.788)
Sargan 4/					101.6 (897)
Number of countries	111	111	111	110	110
Number of observations	2083	2083	2083	1913	1913

1/ Standard errors in parentheses; ** (*) indicates significance at 5 (10) percent.

2/ Estimated in first differences.

3/ Calculated using only significant coefficients.

4/ Degrees of freedom in parentheses.

5/ p-values in parentheses.

trade tax revenue. In any event, however, the Hausman test strongly favors the fixed effects specification.

The third column seeks to address the potential endogeneity of trade tax revenues, since these are potentially liable to shocks that also affect other revenue sources: improvements in customs administration, for instance, might increase receipts from both trade taxes and (through its more effective collection at the border) the VAT. To control for this, the ratio of trade taxes to GDP is instrumented by its own lag (with the insignificant lagged trade tax variable having been dropped). The results are virtually identical to those of the basic fixed effects specification.

To deal also with the potential bias from the inclusion of the lagged dependent variable (although one would not expect this to be large in a panel of this length), the same basic specification is estimated (in first differences) by GMM in the fourth and fifth columns, using as instruments lags dated *t-1* and earlier of all right hand variables other than the lagged dependent variable and (given the potential endogeneity just mentioned) those involving trade tax revenues, for which lags dated *t-2* or earlier are used. The results from the heteroskedasticity-robust one-step estimates in the fourth column and the two-step estimates in the fifth column are broadly similar to one another. The pattern of significance is also much as in the fixed effects and IV specifications, though the values of the coefficients are quite different. The picture that emerges is of somewhat quicker and fuller recovery from trade tax losses, with θ rising to 0.4-0.5 and the mean lag in response falling from about 2.5 years to 2. Moreover, the two-step estimates suggest that those countries with a VAT do systematically recover more revenue from other sources than do those without (though Arellano and Bond (1991) recommend inference from one- rather than two-step estimates). In any event, however, recovery is much less than complete. In terms of standard specification tests, the m_2 statistic does not reject the null of zero second-order serial correlation required for consistency of the GMM estimator. The Sargan statistic, testing for the over-identifying restrictions on the instrument set, is also satisfactory.

Tables 2 to 4 repeat broadly the same series of specifications for the sub-samples comprising respectively low-, middle- and high-income countries. The picture that emerges from the diagnostics is much as for the full sample—with the fixed effects specification being preferred, and the GMM performing satisfactorily—so that in discussing these results we focus on the parameters of key interest.

The results for the sub-sample of low income countries, shown in Table 2, provide virtually no sign of any recovery from losses of trade tax revenue. Indeed non-trade tax revenue in these countries emerges as related essentially only to its own lag and openness. In no case are trade tax-related variables significant. They are almost so (at 10 percent) in the two-step GMM, but even then the implied θ is less than 0.2 (and, moreover, the GMM estimates for this subsample are quite unstable). The absence of a systematic recovery of lost trade tax revenue by low income countries appears quite a robust feature of these data.

Table 2. Low income countries, 1975-2000 1/

	Dependent variable: Non -trade tax revenue				
	(1) FE	(2) RE	(3) IV	(4) GMM (one step) 2/	(5) GMM (two step) 2/
Lagged nontrade revenue	0.674**	0.878**	0.665**	0.645**	0.633**
	(0.030)	(0.019)	(0.031)	(0.048)	(0.03)
Trade tax to GDP	0.019	0.053	-0.068	-0.012	-0.067
	(0.058)	(0.056)	(0.058)	(0.062)	(0.042)
Lagged trade tax to GDP	-0.057	-0.084			
	(0.056)	(0.056)			
Trade tax×VAT dummy	-0.026	0.020	-0.083	-0.074	
	(0.063)	(0.040)	(0.080)	(0.060)	
Log per capita GDP	0.773	0.294	0.812	0.651	1.904*
	(0.573)	(0.200)	(0.577)	(0.861)	(0.998)
Openness	0.024**	0.014**	0.026**	0.027**	0.030**
	(0.007)	(0.004)	(0.007)	(0.011)	(0.002)
Log inflation	-0.066	0.063	-0.061	0.007	-0.033
	(0.090)	(0.073)	(0.091)	(0.115)	(0.093)
Aid per capita	0.001	-0.004	0.001	0.000	0.003*
	(0.005)	(0.003)	(0.005)	(0.004)	(0.001)
Share of agriculture	0.008	0.003	0.007	-0.003	-0.022
	(0.018)	(0.010)	(0.018)	(0.019)	(0.015)
Implied theta 3/					0.183
R^2	0.831	0.850	0.829		
Hausman 4/		93.8** (9)			
m_1 5/				–3.07** (0.002)	–2.88** (0.004)
m_2 5/				0.61 (0.544)	0.66 (0.511)
Sargan 4/					30.49 (574)
Number of countries	35	35	35	35	35
Number of observations	590	590	590	524	524

1/ Standard errors in parentheses; ** (*) indicates significance at 5 (10) percent.

2/ Estimated in first differences.

3/ Calculated using only significant coefficients.

4/ Degrees of freedom in parentheses.

5/ p-values in parentheses.

Table 3. Middle income countries, 1975-2000 1/

	Dependent variable: Non -trade tax revenue				
	(1) FE	(2) RE	(3) IV	(4) GMM (one step) 2/	(5) GMM (two step) 2/
Lagged nontrade revenue	0.666**	0.939**	0.666**	0.581**	0.634**
	(0.025)	(0.013)	(0.025)	(0.066)	(0.039)
Trade tax to GDP	-0.182**	-0.134**	-0.113**	-0.171*	–0.156**
	(0.062)	(0.062)	(0.053)	(0.104)	(0.068)
Lagged trade tax to GDP	0.051	0.158**			
	(0.060)	(0.061)			
Trade tax×VAT dummy	0.073	0.027	0.005	0.110	0.030
	(0.056)	(0.040)	(0.068)	(0.115)	(0.158)
Log per capita GDP	0.118	0.027	0.236	-0.680	-1.789
	(0.506)	(0.148)	(0.514)	(1.053)	(1.222)
Openness	0.007*	0.005**	0.007*	0.018**	0.020**
	(0.004)	(0.002)	(0.004)	(0.007)	(0.003)
Log inflation	0.080	0.123**	0.084	0.154	0.248**
	(0.076)	(0.061)	(0.076)	(0.126)	(0.082)
Aid per capita	-0.004**	-0.001	-0.005**	-0.005**	-0.003**
	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)
Share of agriculture	-0.028	-0.017	-0.030	-0.057	-0.032*
	(0.024)	(0.013)	(0.024)	(0.059)	(0.012)
Implied theta 3/	0.545	2.197	0.338	0.408	0.426
R^2	0.856	0.882	0.859		
Hausman 4/		171.01** (9)			
m_1 5/				–3.21** (0.001)	–3.10** (0.002)
m_2 5/				0.51 (0.611)	0.59 (0.553)
Sargan 4/					38.05 (897)
Number of countries	50	50	50	49	49
Number of observations	968	968	968	896	896

1/ Standard errors in parentheses; ** (*) indicates significance at 5 (10) percent.

2/ Estimated in first differences.

3/ Calculated using only significant coefficients.

4/ Degrees of freedom in parentheses.

5/ p-values in parentheses.

Table 4. High income countries, 1975-2000 1/

	Dependent variable: Non -trade tax revenue				
	(1) FE	(2) RE	(3) IV	(4) GMM (one step) 2/	(5) GMM (two step) 2/
Lagged nontrade revenue	0.851**	0.985**	0.847**	0.828**	0.811**
	(0.023)	(0.007)	(0.023)	(0.021)	(0.03)
Trade tax to GDP	0.333	0.320	-0.505**	-0.415*	0.501
	(0.321)	(0.314)	(0.150)	(0.161)	(0.843)
Lagged trade tax to GDP	-0.739**	0.460			
	(0.321)	(0.305)			
Trade tax×VAT dummy	-0.260	-0.205	-0.205	-0.270	-1.297**
	(0.172)	(0.128)	(0.171)	(0.246)	(0.628)
Log per capita GDP	-0.380	0.248	-0.411	-1.221	1.352
	(0.520)	(0.207)	(0.523)	(1.071)	(1.747)
Openness	0.000	-0.001	0.000	-0.003	-0.001
	(0.006)	(0.001)	(0.006)	(0.010)	(0.004)
Log inflation	0.049	0.180*	0.049	0.171	0.017
	(0.081)	(0.070)	(0.081)	(0.139)	(0.111)
Aid per capita	0.046*	0.031	0.046*	0.049**	0.055**
	(0.025)	(0.023)	(0.025)	(0.009)	(0.013)
Share of agriculture	-0.060	0.041*	-0.046	–0.073*	-0.213
	(0.047)	0.021	(0.047)	(0.041)	(0.169)
Implied theta 3/	4.960		3.301	2.413	6.862
R^2	0.984	0.987	0.983		
Hausman 4/		43.8** (9)			
m_1 5/				–3.24** (0.001)	–3.02** (0.003)
m_2 5/				-0.73 (0.467)	-0.90 (0.371)
Sargan 4/					16.39 (897)
Number of countries	26	26	26	26	26
Number of observations	525	525	525	493	493

1/ Standard errors in parentheses; ** (*) indicates significance at 5 (10) percent.

2/ Estimated in first differences.

3/ Calculated using only significant coefficients.

4/ Degrees of freedom in parentheses.

5/ p-values in parentheses.

For middle-income countries, the results shown in Table 3—plausible and quite consistent across the specifications (other than the random effects model, which is again firmly rejected)—point to recovery from other sources of 35 to 55 cents of each $1 of lost trade tax revenue. This is still far short of full recovery. Moreover, there is no evidence that countries with a VAT recover more.

For high income countries, on the other hand, the results reported in Table 4 imply ultimate recovery of much more than $1 for each $1 of trade tax revenue lost (again, apart from the rejected random effects specification), albeit now with a slower adjustment. While the unexpected significance of the aid variable suggests that the results may be driven by outliers, the natural and plausible conclusion appears to be that for these countries the primary role of trade taxes throughout the sample period has been to serve purposes other than raising revenue.

V. CONCLUSIONS

Further trade liberalization in many developing and emerging markets may be stymied—perhaps, in some cases, should be stymied—unless they are able to develop sources of revenue alternative to the trade taxes upon which they remain heavily dependent. And there are indeed theoretical results and a body of practical advice setting out strategies for doing exactly that, generally recommending increased reliance on broad-based taxes on domestic consumption. This paper, however, has focused on the simple question of fact: Have countries, over the last 25 years, actually managed to replace lost trade tax revenue by revenue from other sources?

The answer that emerges is clear: for high income countries, yes; for others, no. The fairly robust empirical finding is that middle income countries ultimately lose about 45-65 cents of total revenue for each dollar of lost trade tax revenue. Low income countries, more starkly still, recover almost nothing: revenue losses from trade liberalization have been permanent. Of course there are exceptions to these generalizations: Jordan, for instance, managed a significant switch away from trade taxes over the 1990s (in the order of 4 percentage points of GDP) whilst maintaining overall tax revenue broadly constant . But the results here show that these cases are just that—exceptions. It is conceivable, of course, that low income countries have taken the opportunity of trade tax reform to reduce the overall tax burden—conceivable, but hardly plausible in many cases, given the urgency of fiscal needs in many of these countries (taxes accounting on average for only around 14 percent of GDP). The problem is a real one.

Nor do the empirical results here point to any simple solutions: there is no systematic evidence, for instance, that countries with a VAT find it easier to replace trade tax revenues from other sources, There is more to be learned, perhaps from case studies: there are important differences across types of VAT, for instance, that are not captured by the simple VAT-or-not dummy used here. Clearly too the results suggest that there has in the past been

too little coordination between trade liberalization and the strengthening of the domestic tax systems.

The results here do not imply, of course, that reforms which have reduced trade tax revenue in developing countries were unwise. Revenue is clearly not the only policy concern, and indeed it is possible that indirect effects operating through higher levels of income and openness associated with trade reform have more than offset the direct loss of revenue. From the perspective of fiscal prudence, however, the results do suggest that the revenue problem to be faced in taking forward trade liberalization is a serious one, which has received too little attention from analysts and policy-makers alike.

Appendix I. Data Definition and Sources

Trade tax revenue is defined as import and export duties, taken from the GFS or IMF country documents as discussed in the text.

Non-trade tax revenue is defined as total tax revenue excluding trade tax revenue, taken from the GFS database or IMF country documents as discussed in the text.

VAT dummy (with the value of 1 if a VAT is in place in any given year, 0 otherwise) is from information in Ebrill et al (2001).

Log per capita GDP is calculated in constant U.S. dollars, taken from the World Development Indicators database.

Openness is calculated as imports plus exports in percent of GDP, taken from the International Financial Statistics (IFS) database.

Log inflation is the annual change in CPI, taken from the IFS database.

Aid per capita is the amount of official development assistance in U.S. dollars received per capita, taken from the World Development Indicators database.

Share of agriculture is the share of agriculture in value added in the economy, taken from the World Development Indicators database.

References

Agbeyegbe, Terence, Janet Stotsky and Assi Woldemariam (2004), " Trade liberalization, exchange rate changes, and tax revenue in Sub-Saharan Africa," mimeo, IMF.

Arrelano, Manuel and Stephen Bond (1991), "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations," *Review of economic Studies*, Vol. 58, pp. 277-97.

Ebrill, Liam, Janet Stotsky, and Reint Gropp (1999), *Revenue Implications of Trade Liberalization*, IMF Occasional Paper No.180 (Washington: International Monetary Fund).

Ebrill, Liam, Michael Keen, Jean-Paul Bodin and Victoria Summers (2001), *The Modern VAT* (International Monetary Fund: Washington D.C.).

Hatzipanayotou, P., M.S. Michael, and S. M. Miller (1994), "Win-win indirect tax reform: A modest proposal," *Economics Letters*, Vol. 44, pp. 147–51.

Keen. Michael and Jenny Ligthart (2001), "Coordinating tariff reductions and domestic tax reform," *Journal of International Economics*, Vol. 56 (2001), pp. 407–425.

Keen, Michael and Jenny Ligthart (2003). "Coordinating tariff reduction and domestic tax reform under imperfect competition," forthcoming in the *Review of International Economics*.

Keen, Michael and Alejandro Simone (2004), "Tax policy in developing countries: Some lessons from the 1990s, and some challenges ahead," forthcoming in Sanjeev Gupta, Ben Clements, and Gabriela Inchauste (eds): *Helping Countries Develop: The Role of the Fiscal Policy* ((International Monetary Fund: Washington DC)

Khattry, Barsha, and Mohan Rao, (2002), "Fiscal faux pas? An analysis of the revenue implications of trade liberalization," *World Development*, Vol. 30, pp.1431–44.

Michael, Michael S., P. Hatzipanayotou, and S.M. Miller (1993), "Integrated reforms of tariffs and consumption taxes," *Journal of Public Economics*, Vol. 52, 417–28.

Rodrik, Dani, (1998), "Why do more open economies have bigger governments?" *Journal of Political Economy*, Vol. 106, pp. 997–1032.

Tanzi, Vito (1987), "Quantitative characteristics of the tax systems of developing countries," in *The Theory of Taxation for Developing Countries*, ed. by D. Newbery and N. Stern (Oxford: Oxford University Press), pp. 205–41.

Rajaraman, Indira (2004), " Fiscal restructuring in the context of trade reform," National Institute of Public Finance and Policy, Delhi, Working Paper No. 7, Working Paper No. 7.

Wacziarg, Romain and Welch, Karen H. (2003), " Trade liberalization and growth: New evidence," NBER Working Paper 10152.