

IMF Working Paper

A Partial Race to the Bottom: Corporate Tax Developments in Emerging and Developing Economies

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with Sukhmani Bedi and Junhyung Park*

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Fiscal Affairs Department

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Abstract

This paper assembles a new dataset on corporate income tax regimes in 50 emerging and developing economies over 1996-2007 and analyzes their impact on corporate tax revenues and domestic and foreign investment. It computes effective tax rates to take account of complicated special regimes, such as partial tax holidays, temporarily reduced rates and increased investment allowances. There is evidence of a partial race to the bottom: countries have been under pressure to lower tax rates in order to lure and boost investment. In the case of standard tax systems (i.e. tax rules applying under normal circumstances), the effective tax rate reductions have not been larger than those witnessed in advanced economies, and revenues have held up well over the sample period. However, a race to the bottom is evident among special regimes, most notably in the case of Africa, creating effectively a parallel tax system where rates have fallen to almost zero. Regression analysis reveals higher tax rates adversely affect domestic investment and FDI, but do raise revenues in the short-run.

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I. INTRODUCTION

Corporate income tax developments have been much studied and have received significant political and media attention. The ongoing globalization of businesses, with tax systems remaining largely in the hands of national governments, has led to a number of actual and perceived conflicts. For instance, tax competition is often mentioned as a force that drives down corporate income taxes across countries in a “race to the bottom.” Additionally, tax revenues are seen as under threat from advanced tax planning of companies taking advantage of the complicated interactions of international tax systems.

The theoretical literature has not yet reached a clear consensus on the likely outcome of tax competition, or on whether this is an overall beneficial, irrelevant or harmful development.² The basic idea that the revenue yield of a tax on mobile factors will depend on taxes in other jurisdictions has, however, become generally accepted.

At the same time, empirical evidence on corporate income tax developments in developing economies remains scant, with most of the existing studies looking at corporate income tax (CIT) developments focus on advanced economies.³ Devereux, Griffith and Klemm (2002), for instance, look at tax law-based effective tax rates and tax revenues in advanced economies over 1960-99 and report the following stylized facts: (i) statutory tax rates have fallen; (ii) tax bases have been broadened; (iii) effective tax rates have fallen, especially for investments with high rates of profitability; (iv) tax revenues have remained stable as a share of GDP; (v) tax revenues have fallen as a share of total tax revenue since the 1960s, but have stabilized since the 1980s. There is, at present, no comparable study documenting such stylized facts in developing economies, let alone analyzing the impact of CIT developments on government revenues and investment.

This paper aims to fill this void through a comprehensive study of the evolution of CIT systems in emerging and developing economies⁴ since the mid-1990s until the global financial crisis in 2008. Beyond the intrinsic importance of these economies and their growing weight in the global economy, their behavior in this area may well differ from that of advanced economies, for several reasons:

² The literature is summarized in Wilson (1999), and more recently Fuest, Huber and Mintz (2005). Most early tax competition models are based on the idea that globalization increases the elasticity of capital with respect to taxation. This increases the marginal cost of raising public funds and therefore reduces welfare. However, when other taxes are available, such as taxes on less mobile factors, or if governments raise taxes for reasons other than welfare maximization, then tax competition can be less harmful or even beneficial in some models.

³ This is possibly because the earliest work in the area was undertaken by institutions that focus on advanced economies – see, for example, OECD (1991) and European Commission (1992).

⁴ We use the term “developing and emerging” country loosely and include as many economies of growing importance as we could cover with our data. Some of them are indeed advanced economies under the WEO classification, e.g., Israel.

- The typical emerging market is smaller, faces a more elastic supply of international capital, and has a smaller base of local investors, so that pressures to cut tax rates are likely to be stronger (e.g., Bucovetsky, 1991).
- Tax administration and enforcement capacity is often more limited, so that the threat to revenues from aggressive tax planning would be greater.
- The structure of the economy, with many small producers operating outside the formal sector or officially exempt on the grounds of their size, could lead to high dependence of revenue authorities on a few large businesses. More generally, CIT makes up a larger share of total tax receipts.
- Developing economies would also be expected to rely more on generous special regimes and holidays in a bid to attract foreign investors otherwise wary of contact with inefficient or corrupt tax administrations.

This paper uses a newly-constructed dataset of effective corporate tax rates in 50 emerging and developing economies over 1996-2007 to document developments therein (see Table 1 for a list of countries). The few papers on corporate income tax developments in developing economies that already exist suggest that the topic is worth pursuing further. Keen and Simone (2004) collect data on tax incentives in 40 developing economies over 1990-2002 and find that unlike advanced economies, which have tended to broaden tax bases and cut tax rates while maintaining revenues, developing economies have cut rates, introduced special regimes and lost revenues. Keen and Mansour (2010) look at corporate income tax developments in Sub-Saharan Africa and find that bases have narrowed—especially through the spread of tax holidays and special zones—but surprisingly, tax revenues have held up in this region.⁵ The paper, however, only reports a count of the number of special regimes in a country, and does not track their generosity or calculate their impact on effective tax rates. Our paper is also related more generally to the growing literature on tax incentives.⁶ This literature covers the theoretical effects of special regimes as well as their empirical impact. There is, however, to the best of our knowledge, no comprehensive study looking at general corporate income tax developments in emerging economies, while fully integrating special regimes into the analysis.

Our approach is to prepare a panel of effective (marginal and average) tax rates, which summarize all tax laws, including those defining the rate, the base, and any special regime. Our effective tax rate computations are based on an extension of the methodology proposed by Devereux and Griffith (2003), which allows the calculation of tax law-based measures for rent-earning investments and includes the effective marginal tax rate as a special case (see Appendix I for detailed derivation). Briefly, the rates are obtained by constructing a forward-

⁵ Many more papers exist that focus on one or a few countries or at best a region, but without a wide panel it is hard to draw general lessons from country experiences.

⁶ For an overview see Shah (1995), OECD (2001), Zee and others (2002), and Klemm (2010).

looking hypothetical investment project and calculating the impact of the tax system (CIT rate, depreciation allowances, holidays etc.) on the cost of capital of a profit-making value-maximizing firm. Specifically:

- The effective *average* tax rate (EATR) is the ratio of the present value of taxes to the present value of profits. This can be calculated for any *discrete* investment project, including one where a positive economic rent is expected *ex ante*. An example of such a project would be a multinational company which owns a patent or special production process, and which is deciding on a place to locate, and is interested in how much rent remains after tax.
- The effective *marginal* tax rate (EMTR) is a special case of the EATR, where a project just breaks even, i.e., yields a post-tax economic rent of nil. This is the relevant rate for companies operating at the margin, i.e., typically incremental investment of firms in competitive industries, where firms decide on whether to invest an extra dollar.

The advantage of using effective tax rates is that they combine complex information about the statutory tax rate, the level and type of depreciation allowances, the years of reduced tax rates or even tax holidays, and any special investment allowances, into a *single* measure. This measure expresses the tax liability as a share of the present value of all financial profits expected from an investment. The effective tax rate therefore is based on many factors, including the expected rate of profitability, the type of assets invested in (because depreciation allowances differ across buildings and plants and machinery), and the type of financing used (because of interest deductibility). It can be negative because, for some investments, the tax advantages can be greater than profits.

We use common assumptions across time and space so that any difference in tax rates reflects a difference in the tax system only (unlike some other studies which are based on typical companies, so that financing sources and rates of return differ across countries). We consistently report both the EMTR and EATR.⁷ To reflect the importance of special tax regimes in developing economies, we consider not only tax rates based on the standard tax system, but also a newly-developed extension that allows for special regimes, including complicated ones, where a reduced tax rate applies for a few years of an investment.⁸

We use our new dataset to document summary trends in CIT rates, statutory and effective, and related variables of interest over the 1996-2007 period (Section II). We then study

⁷ Although a country with a high EATR would typically also have a high EMTR (and vice versa), the country's exact ranking on the two measures may not be the same. For instance, a country with a high statutory rate and generous allowances will have a high EATR, because the investment allowance will make up for a small share of profits, but a low EMTR, because the generous allowance may cover most or all of the tax liability, reducing the relevance of the statutory tax rate.

⁸ This builds on Klemm (2008), which develops an effective average tax rate allowing for tax holidays. See also Mintz (1990) which develops an effective marginal tax rate taking account of tax holidays.

episodes of large changes in effective average and marginal tax rate to better understand the motivation of such changes, as well as to get a preview of their revenue/investment impact (Section III). We then estimate a battery of panel regressions, where the regressands are, respectively, CIT revenues, private domestic investment, and FDI (Section IV). Section V concludes and charts out possible directions for further research.

II. DATA AND STYLIZED FACTS

The main source of data for our computation of effective tax rates is the annual worldwide corporate tax guides published by Price Waterhouse Coopers and Ernst and Young over 1995-2007. The guides cover all advanced, many emerging, and some developing economies. Sufficient time series information was reported for the following economies, which constitute our sample (Table 1).

Table 1. Sample of Emerging and Developing Economies

Africa	Asia	Europe	Latin America
Botswana	China	Azerbaijan	Argentina
Egypt	Hong Kong SAR	Bulgaria	Brazil
Ghana	India	Czech Republic	Chile
Kenya	Indonesia	Estonia	Colombia
Mauritius	Korea	Hungary	Costa Rica
Morocco	Malaysia	Israel	Ecuador
Namibia	Pakistan	Kazakhstan	Mexico
Nigeria	Philippines	Latvia	Panama
Senegal	Singapore	Lithuania	Paraguay
South Africa	Sri Lanka	Poland	Peru
Tanzania	Taiwan Province of China	Romania	Uruguay
Uganda	Thailand	Turkey	
Zambia	Vietnam	Ukraine	

The guides report essential business tax regime data, such as statutory tax rates, depreciation and other investment allowances, as well as details on special tax regimes (special allowances, reduced tax rates or outright tax holidays). Information on the regimes is disaggregated by the type of asset (building vs. plant/machinery) and the nature of activity (manufacturing, services, mining etc.). Appendix II provides further details on our use of raw and secondary data sources.

The methodology detailed in Appendix I enables us to convert these raw data into effective tax rates (including for special regimes). The level of a computed effective tax rate naturally depends on particular assumptions about the nature of the hypothetical investment, its rate of return, and its method of finance (debt or equity). For the purposes of this paper, we assume a manufacturing investment in plant and machinery, equity finance, and for the EATR, a rate of return of 20 percent.

The regional and aggregate trends in corporate taxation, including statutory, effective average and marginal rates (the latter as per the definition above) are reported below.

Standard tax systems

Figure 1 reveals a declining trend in statutory corporate tax rates in emerging and developing economies (simple averages across countries) since the mid-1990s, from about 31 percent to 26 percent. The pattern holds for each region, as well as when using medians. The most pronounced rate reductions occurred in Europe, which initially had the highest tax rate. With several transition economies sharply reducing their tax rates, Europe had the lowest average statutory tax rates at the end of the sample period, at 21 percent. Moderate reductions were observed in Africa and Asia, while Latin America's rate edged down slightly. These developments are broadly comparable to those observed in advanced economies. As documented in Devereux et al (2002), statutory corporate tax rates in G-7 and EU countries fell by 12-15 percentage points, on average, over 1982-2001.

Figure 1. Statutory Corporate Income Tax Rate

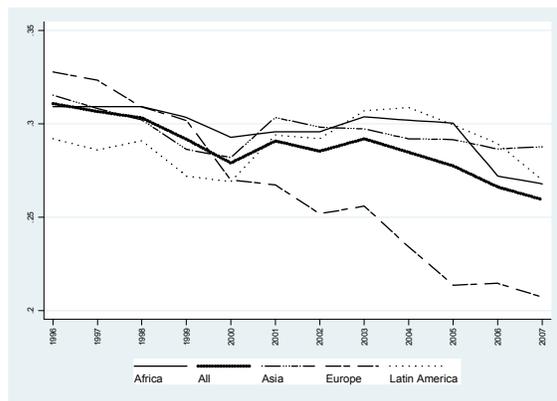
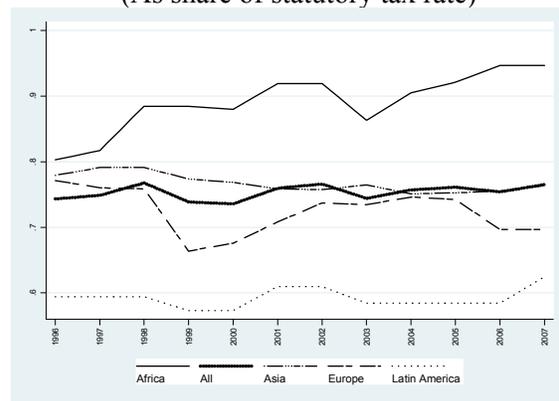


Figure 2. PDV of Depreciation Allowances (As share of statutory tax rate)



Source: Authors' calculation based on dataset described in Appendix II.

Figure 2 documents developments in the tax base for projects that do not qualify for special regimes. The measure shown is the present discounted value of depreciation allowances, normalized by the tax rate (to abstract from the automatic reduction in its value if the tax rate is cut). Hence a fall in this measure would imply a broadening of the tax base. The figure reveals that tax bases were kept stable in most regions, except in Africa, where they were made narrower. This is in direct contrast to advanced economies where, as noted by previous studies, tax bases were broadened on average.

Figures 3-4 show effective marginal and average tax rates. As would be expected, the decline in the statutory tax rate implies a fall in effective average tax rates in every region. However, for marginal rates, Africa displays a major reduction, as a result of the combination of narrower tax bases and lower rates. Overall, with the exception of Africa, the trend is declining gradually in emerging and developing economies, similar to developments in advanced economies, where, as noted in Devereux et al (2002), comparable effective average (marginal) tax rates declined by about 10 (5) percentage points over 1982-2001 (1990-2001).

Figure 3. Effective Marginal Tax Rate

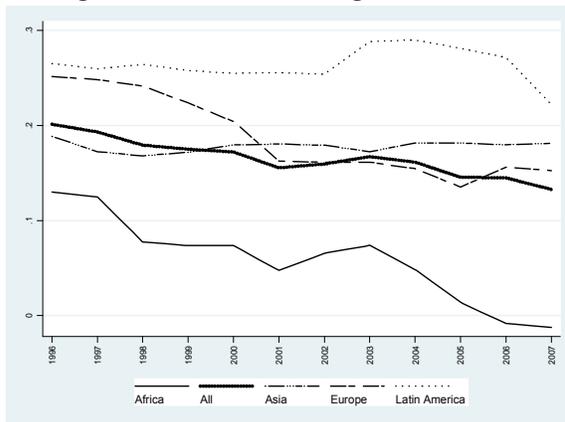
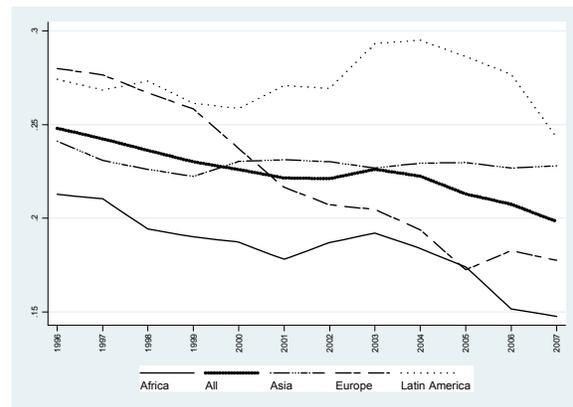


Figure 4. Effective Average Tax Rate



Source: Authors' calculation based on dataset described in Appendix II.

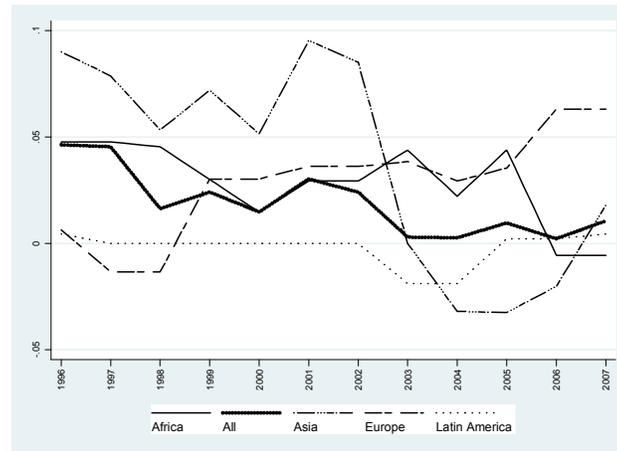
Special regimes

We now analyze changes in the generosity of special regimes offered by countries, while noting our inability to comment – due to paucity of data – on the share of business actually subject to such regimes. Specifically, the trends reported below capture the evolution of the most generous special regimes – as specified in the tax code – and not the relative importance of special regimes vis-à-vis standard regimes.

Figure 5 indicates that effective average tax rates under the most generous regimes have more than halved from an already low level.⁹ What is interesting, though, is the asymmetry between Europe, which has started to roll back the generosity of its special regimes, and Africa, where effective average rates fell further to zero. These trends confirm anecdotal evidence of governments in some low-income economies attempting to attract foreign direct investment with extremely generous incentive schemes.

⁹ To generate the regional average for a given year, the most generous regime was identified for each country within the region in that year, and a simple average taken of the corresponding effective tax rates across countries.

Figure 5. Effective Average Tax Rate Under Most Generous Special Regime



Source: Authors' calculation based on dataset described in Appendix II.

Tax revenues

Turning to total tax revenues (Figure 6), and corporate income tax revenues (Figure 7), we find stable or rising trends across all regions over 1996-2007 (prior to the eruption of the global financial crisis in 2008). Total tax revenues took a dip around the late 1990s/early 2000s during the outbreak of emerging market crises and the temporary slowdown in advanced economies around 2001 (following the bursting of the dot com bubble). Since then, corporate tax revenues rose more sharply than aggregate revenues, resulting in an increase in the CIT/total tax revenue ratio from 17 to 21 percent over the period (Figure 8). In part, this reflects the high elasticity of corporate taxes to the cycle, and the surge in corporate financial profits during the boom leading up to the global financial crisis.

However, noting that the increase went beyond the levels seen in 1996 (i.e., prior to the Asian crisis), there may be a more structural aspect to this – for example, stronger tax administrations (especially in Latin America), and the formalization of business that would be expected with economic development. These trends differ from those in advanced economies, where corporate income tax revenues also held up as a share of GDP, but fell as a share of total tax revenues, mainly at the expense of indirect taxes. Overall, these charts cannot discriminate between many possible explanations, ranging from the possibility that tax revenues rose because lower rates encouraged economic activity, to the possibility of major tax losses compared to a cooperative scenario, in which all countries had agreed on higher effective taxation. But they certainly suggest that despite the decline in effective tax rates, revenues remained strong, which may ease immediate concerns about tax competition limiting the revenue capacity of governments.

Figure 6. Total Tax Revenue
(In percent of GDP)

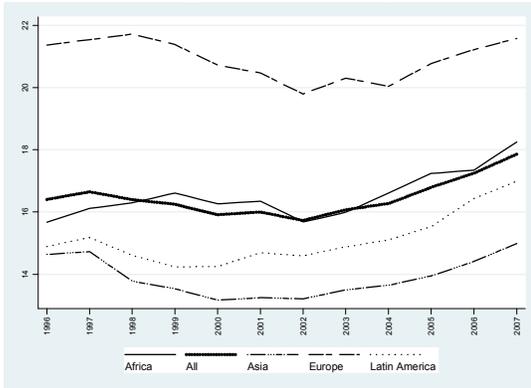
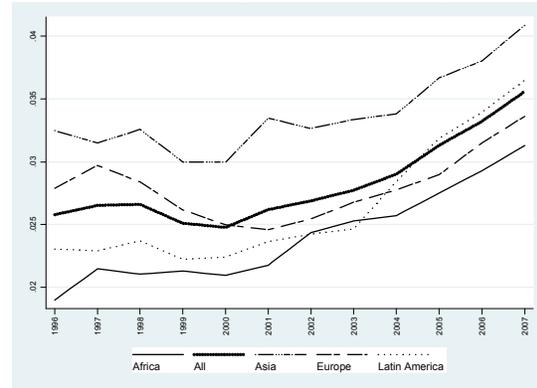
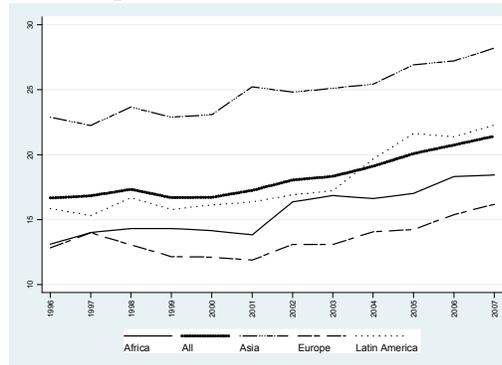


Figure 7. Corporate Tax Revenue
(In percent of GDP)



Notes: Taxes exclude social security contributions (so correspond more closely to central government definition) and, where applicable, oil revenues (in which case, scaling is to non-oil GDP).

Figure 8. Corporate Taxes as a Share of Total Taxes



Source (Figures 6-8): Authors' calculation based on dataset described in Appendix II.

Domestic and foreign investment

As the empirical analysis will look at the impact of taxes on investment, we also present a few charts to depict the broad developments in gross private capital formation and foreign direct investment. Trends in gross private capital formation bear out the moderation in investment in Asia and Latin America following the crises in the late 1990s/early 2000s (Figure 9). By contrast, investment in Africa, starting from a low base, rose consistently, while that in Europe rose to high levels after 2000, reflecting the surge in real estate activity as well as broader forces of convergence (including via EU funds). Inward foreign direct investment (Figure 10) also firmly trends upward over the period, interrupted by a brief trough in the early 2000s. The impact of the lending boom to emerging Europe and the FDI cycles for Asia and Latin America are evident, as is the gradual but certain build-up of FDI to Africa since 2004.

Figure 9. Gross Fixed Capital Formation
(In percent of GDP)

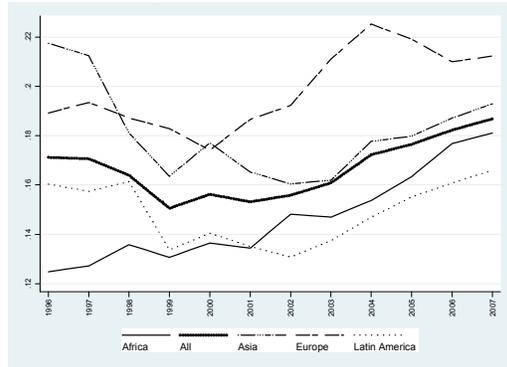
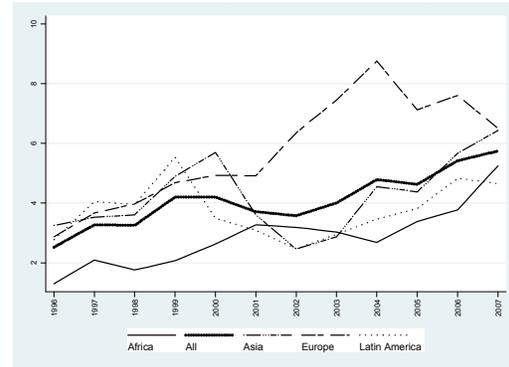


Figure 10. Inward Foreign Direct Investment
(In percent of GDP)



Source: Authors' calculation based on dataset described in Appendix II.

III. EPISODES OF LARGE CHANGES IN EFFECTIVE TAX RATES

We now turn briefly to documenting some actual country episodes of large increases and decreases in average and marginal effective tax rates. The purpose is two-fold: (i) to better understand the context and motivation for these changes (e.g., do marginal tax reductions happen when investment is low?); and (ii) to analyze the extent to which outcomes after the changes aligned with ex-ante expectations, including to help sharpen our priors for the econometric investigation in the next section.

To identify the relevant country episodes we first extracted a sample of all continuous increases or reductions in the effective average tax rate (EATR) – similarly for effective marginal tax rate (EMTR) – that occurred during the 1996-2007 period.¹⁰ Among these, large episodes were simply defined as those where the change was bigger than the sample median. This methodology yielded a total of 44 episodes (16 large increases and 28 large decreases) for EMTR (and similarly, 46 episodes for EATR), as listed in Appendix III.¹¹

The fact that the number of declines is double the number of increases is consistent with the overall trend of declining effective tax rates (ETRs) documented in the previous section. Importantly, two-third of the episodes had a duration of less than 3 years, indicating the relatively short period over which governments implement these changes. There is an interesting asymmetry across tax increases and decreases, though, with the median decrease

¹⁰ Temporary (one-year) reversals of 1 percentage point were not deemed to interrupt an episode. Thus if country *i* reduced its effective average tax rate from 20 percent in 2000 to 17 percent in 2001, then raised it 18 percent in 2002, but resumed the downward reduction till say, 2004, to a level of 15 percent, the episode was recorded as a 5 percentage point reduction starting in 2000 and ending in 2004.

¹¹ Turkey, Mexico and Estonia are excluded because of the very large changes in their EMTRs: Turkey (3yrs, starting 2003, +330 percentage points); Mexico (3yrs, starting 1996, +250 percentage points); Turkey (1yr, starting 1998, -300 percentage points); and Estonia (1yr, starting 1998, -130 percent). Inclusions of these episodes would skew the reported averages.

phased over 3 years, whereas the median increase taking 1 year. This is despite the fact that the median increase and decrease were roughly similarly sized (6 and 9 percentage points for EATR increases and decreases; and 14 and 18 percentage points for EMTR increases and decreases).

The generosity of special regimes behaved somewhat asymmetrically around large ETR increases and declines (Table 2). While roughly half of ETR increases were accompanied by a tightening of the country's most generous regime, two-third of EATR declines were accompanied by a relaxation in the most generous regime. A similar pattern can be seen for statutory tax rates: an overwhelming number (47) of ETR declines coincided with (or were driven by) statutory tax rate reductions, while ETR increases were associated with rising, falling or unchanged statutory tax rates in a roughly equal number of cases (10). This may indicate an increasing unwillingness on the part of governments to raise ETRs via statutory rate increases which may send an undesirable signal to foreign investors.

Table 2. Large Effective Tax Rate Changes, Special Regimes and Statutory Rates

		No. of episodes of large effective tax rate:		Total
		<i>Increases</i>	<i>Decreases</i>	
No. of episodes in which generosity of most generous regime:	<i>Increased</i>	5	21	26
	<i>Decreased</i>	6	10	16
	<i>Was unchanged</i>	2	1	3
	<i>No information</i>	18	27	45
Total		31	59	90

		No. of episodes of large effective tax rate:		Total
		<i>Increases</i>	<i>Decreases</i>	
No. of episodes in which statutory tax rate	<i>Increased</i>	9	3	12
	<i>Decreased</i>	10	47	57
	<i>Was unchanged</i>	12	9	21
	Total	31	59	90

Source: Authors' calculation based on dataset described in Appendix II.

Turning to the likely motivation behind large ETR changes, Table 3 compares the initial levels (proxied by the average of one-year and two years prior values) of key tax and investment ratios for large ETR increases with those for large ETR decreases. The emerging picture appears intuitive. Low tax revenues (total and corporate) and relatively high investment (domestic and foreign) have provided the context for large EATR increases, and vice versa for large EATR decreases. A similar pattern obtains for large EMTR increases and decreases as well, although revenues no longer appear to be the differential factor. Instead, domestic investment is noticeably low in the run-up to large EMTR decreases, suggesting its possible role as a motivating factor.

Table 3. Comparing Initial Variable Levels Across Large ETR Increases vs. Decreases
(Average of year t-1 and year t-2 mean values over episodes)¹²

<i>percent of GDP</i>	EATR	EATR	EMTR	EMTR
	<u>increases</u>	<u>decreases</u>	<u>increases</u>	<u>decreases</u>
Total tax revenue	14.1	17.2	15.0	16.8
Corporate tax revenue	2.4	2.8	2.4	2.5
Gross private investment	16.0	15.6	15.9	14.4
Inward FDI	3.2	2.9	3.0	2.7

Source: Authors' calculation based on dataset described in Appendix II.

Finally, to develop some priors for the impact of these large tax changes, we plot *changes* in tax revenue and investment ratios vs. changes in ETRs for each episode. The vertical axis of the top left chart in Figure 11 reports the increase in the corporate tax revenue-to-GDP ratio, as proxied by the ratio's average during years t+2 and t+3 *minus* the ratio's average during years t-1 and t. The positive slope passing through the scatter plot implies that large EATR increases have been associated with some strengthening of corporate tax revenues (a 10 percentage point increase in the EATR coincides with a 0.2 percent of GDP increase in corporate tax revenue).

The relationship between large EMTR changes and domestic investment changes appears counter-intuitive, but is quite weak and may be overly-influenced by the investment trough of the early 2000s. The association between EATR changes and changes in FDI is consistent with the view that foreign investment responds favorably to a lowering of EATRs. However, the chart with FDI shares suggests some support for the harmful tax competition thesis, as some of the FDI increase in the EATR-reducing country appears to have resulted from a gain in market share vis-à-vis competitor developing economies (proxied here by other host countries in the region), rather than new investment to the region.

¹² To illustrate: the amount of 14.1 percent of GDP in the first column was obtained as follows. We computed the mean level of total tax revenue in year t-1 across all large EATR increases. The same was calculated for year t-2. The average of these two means was 14.1.

IV. ESTIMATING THE IMPACT OF CORPORATE TAXATION ON REVENUES AND INVESTMENT

Explaining corporate income tax revenues

Using a similar approach as Clausing (2007), we relate corporate income tax revenues to the statutory tax rate, the tax base and share of profits in GDP:¹³

$$\left(\frac{CIT\ revenue}{GDP} \right)_{i,t} = \beta_0 + \beta_1 \tau_{i,t} + \beta_2 \tau_{i,t}^2 + \beta_3 \frac{b_{i,t}}{\pi_{i,t}} + \beta_4 \frac{\pi_{i,t}}{GDP_{i,t}} + f_i + y_t + \varepsilon_{i,t}$$

where τ is the statutory tax rate, b is the tax base, π are profits, β_j are coefficients, f_i are country effects, y_t are year effects and $\varepsilon_{i,t}$ are errors.¹⁴

The inclusion of the squared statutory tax rate term aims to capture possible nonlinearities which could arise from factors such as the impact of high tax rates on firms' incentive to circumvent the official regime. Further, differences between π (profits) and b (tax base) can arise due to firms' attempts to report their profits in "tax-preferred" activities. Thus, countries maintaining generous depreciation allowances, for example, or special regimes, would likely observe a larger wedge between π and b than countries without them. We proxy the share of the tax base in profits by the ratio of the present discounted value of true economic depreciation to the present discounted value of depreciation allowances.¹⁵ This is therefore a control for changes in the tax law that affect (one aspect of) the tax base.¹⁶ Note that the inclusion of both the statutory tax rate and the legal measure of the tax base implies that we consider the effective average tax rate too, as it is a weighted average of both (see Devereux and Griffith, 2003).

Like Clausing (2007), we proxy the share of profits in the GDP by the gross operating surplus, which is a national accounts concept and for which some data are available. Unfortunately we do not have data on corporate profits, which are likely to be different, because the gross operating surplus includes profits from unincorporated businesses, and

¹³ Clausing (2007) additionally splits the ratio of profits over GDP into the product of the ratio of profits to value added and value added to GDP, but we do not have data on corporate value added.

¹⁴ We systematically use standard errors that are robust to heteroskedasticity and within-group serial correlation. Hausman tests reject the random effect in favor of the fixed effect model for most regressions, and we use fixed effect estimators throughout for consistency.

¹⁵ We are interested in the ratio of the tax base to profits. This ratio is greater than 1 if the tax base is broad, i.e., if deductions are smaller than true economic costs. This ratio can therefore be proxied by the ratio of the PDVs of true economic depreciation to statutory depreciation, which is equally exceeds 1 if the tax base is broad.

¹⁶ Like Clausing (2007), we cannot directly control for changes in the tax base that result from behavioral changes, as we do not have the required data.

because there are various other accounting differences, especially in the financial sector. And even the gross operating surplus is available for just 57 percent of the observations in our sample, so that we do not use it systematically, but only as a robustness check.

Table 4. The Impact of Tax Rates on Corporate Tax Revenue

	(1)	(2)	(3)	(4)	(5)
Tax rate	0.046*** (0.015)	0.046*** (0.014)	0.116* (0.058)	0.064*** (0.015)	0.061*** (0.015)
Gross operating surplus	0.018 (0.014)				
Base/profits	-0.003 (0.004)	0.001 (0.003)	0.002 (0.003)	0.000 (0.003)	0.001 (0.002)
Growth	0.006 (0.013)	-0.011 (0.014)	-0.010 (0.014)	-0.010 (0.014)	-0.010 (0.014)
Tax rate, squared			-0.129 (0.099)		
Tax rate*spec. reg. dummy				-0.032* (0.017)	
Special regime dummy				0.012** (0.005)	
Tax rate*Africa dummy					-0.058** (0.026)
Observations	300	530	530	530	530
Countries	29	47	47	47	47
R2	0.421	0.345	0.351	0.364	0.363
Adj. R2	0.390	0.327	0.332	0.344	0.344

Notes: Dependent variable: corporate income tax revenue as a share of GDP. Cluster-robust standard errors in parentheses. Stars indicate level of significance: ***: 1 percent, **: 5 percent, *: 10 percent. All regressions include year dummies and country fixed effects.

The first regression in Table 4 includes the three basic explanatory variables, i.e., the tax rate, the tax base ratio and the gross operating surplus (in percent of GDP). Its results indicate that tax revenues increase with the tax rate. A broader tax base does not appear to have an impact on tax revenues. This can be explained by the fact that this variable is very stable and therefore largely captured by the country fixed effects. In a simple OLS regression of the tax revenue on the three tax main variables, the coefficient turns significant, indicating that countries with broader tax bases do have higher revenues. The absence of an impact of the profit share in GDP on revenues is likely due to the fact that gross operating surplus as measured in national accounts is too far removed from taxable profits.

The second equation drops the gross operating surplus, as it has reduced the sample size and was not significant. Results are not much affected, but the sample size increases. The third regression adds the square of the statutory tax rate, to allow for a non-linearity. Unlike Clausing (2007), we do not find this to be significant for our sample. The fourth regression allows for the presence of special regimes. When such regimes are offered, the impact of an increase in the tax rate is reduced by half. The likely reasons are that in such countries an increase in the tax rate affects only firms outside the special regime. Moreover, there is likely to be a behavioral response driving even more profits into the special regimes.

The fifth and final regression allows the impact of changes in the tax rate to differ across regions. Specifically, this regression interacts the tax rate variable with a dummy for Africa. It shows that, for African countries, the impact of an increase in the tax rate on revenue is significantly different from other regions. Indeed, in Africa, increasing tax rates has apparently no impact on revenues. We have repeated this analysis for all other regions, but for none of them was the difference in coefficients significant. This raises the interesting question of why tax increases in Africa do not appear to benefit revenues. Possible explanations include that the prevalence of special regimes means that the standard tax rate is irrelevant, or that firms react to tax rate increases by shifting profits or real activity elsewhere in such an extreme fashion as to reduce the tax rate by enough to cancel out the effect of the higher rate.

Overall these results have shown that, despite tax competition, tax revenues are a function of the tax rate (except in Africa), although this link is weakened in the presence of special regimes. The result is not trivial, as it certainly rules out extreme capital tax elasticities, which could have led to an inverse relationship between revenues and tax rates. In the medium to long term, however, it is less clear whether a direct relationship would continue to hold. Indeed, if lower tax rates encourage investment (as we find in the next section) or participation in the formal economy, the share of taxed profits in GDP may increase over time. In that eventuality, the long-term effect of higher tax rates would be much smaller than the short-run revenue cost.

The impact of taxes on investment

The second part of the econometric analysis considers the impact of taxes on investment. The empirical literature on this topic is much richer than on explaining corporate income tax revenues and is surveyed in Hines (1999). De Mooij and Ederveen (2003 and 2008) contain meta-analyses based on up to 31 empirical studies. The broad conclusion from the literature is that taxes do appear to have a negative impact on investment, although the size of that effect differs across samples and methodologies. The median semi-elasticity, according to De Mooij and Ederveen (2008) is -2.9, meaning an increase in the tax rate by 1 percentage point would reduce investment by 2.9 percent. Still, they note that many studies do not find a significant impact: just under half of the studies on the elasticities for FDI, and a third of those on elasticities for investment (property, plant and equipment) find no significant effect. The contribution of this paper is to expand the sample from the usual one of advanced economies to emerging markets and to consider special regimes.¹⁷

Given the wide literature, countless specifications have been tried. We use a standard approach and regress private investment as a share of GDP on its lag, on an effective average tax rate, and control variables:

¹⁷ Klemm and Van Parys (forthcoming) consider the related issue of the impact on tax incentives on investment in African, Latin American and Caribbean countries. They find that FDI is responsive to the tax rate and some tax incentives, while total private investment is not.

$$\left(\frac{I}{GDP}\right)_{i,t} = \beta_0 + \beta_1 \left(\frac{I}{GDP}\right)_{i,t-1} + \beta_2 \tau_{i,t} + x_{i,t}' \beta + f_i + y_t + \varepsilon_{i,t}$$

where I is investment, τ is an effective tax rate and x is a vector of control variables.

In estimating the equation, the inclusion of a lagged dependent variable in a panel has to be taken into account. This typically biases the within-groups estimator, although the bias diminishes as the panel gets longer (Nickell, 1981). The system GMM estimator, developed by Blundell and Bond (1998) provides unbiased estimates of such regressions as the number of groups is increased. Given that our panel is neither very wide nor long, we systematically use both estimators. For all GMM regressions we perform the required specification tests, and they are always met. Specifically, we do not reject the assumption of no serial correlation in the levels equation (which is equivalent to no serial correlation in the AR(2) process of the differenced error), and pass the Sargan/Hansen test of over-identifying restrictions. The relevant test statistics are reported in the regression tables.

Results for total domestic investment are shown in Table 5, with each specification estimated twice, first employing the within-groups estimator and then the system-GMM estimator. The first two regressions consider the marginal effective tax and control variables. The results show that the marginal effective tax rate has no impact on investment. This suggests that when the tax rate rises on marginal projects (i.e., projects that just break even after tax), the impact on aggregate investment is negligible.

The third and fourth regressions consider instead the average effective tax rate. These results show a significant negative impact on investment. This suggests that rent-earning investments react to tax changes and that this has an impact on aggregate investment.

The fifth and sixth regressions consider also the effective average tax rate applicable to the most attractive special regime. This turns out to be insignificant. There are many possible explanations. Either investors do not undertake new investment in response to special regimes, but simply shift existing investment into the special regimes.¹⁸ Or, the more relevant feature of special regimes is not the absolute value of the average tax burden, but the ease with which an investor can benefit from it. Therefore the presence of a special regime may boost investment, but not the precise rate, which in most cases is very low. Moreover, even the coefficient on the standard EATR turns insignificant. Thus, when special regimes are present, standard tax system does not seem to matter much for investment anymore. This could be because most tax-sensitive investment then goes into the special regime, though, admittedly, the results of the final specification are likely to be weakened by the unavoidable reduction in the sample size.

¹⁸ This is also in line with Klemm and Van Parys (forthcoming) who find no impact of tax incentives on investment.

In line with the regressions on tax revenue, we also considered interactions with regional dummies, but coefficient was not found to be significantly different from the overall average for any region.

Table 6 considers FDI instead of total investment, and finds that this is similarly affected. One difference is that for the EATR the result now depends on the estimation method. Using a within-groups estimator we replicate the general negative impact of the EATR on investment. Using GMM, instead, we find a negative impact only for the EATR applicable to special regimes. This latter finding is intriguing, as it would suggest that FDI reacts to special regimes only, but should not be overstressed, because of the reduction in the number of countries. Note that the general finding of a negative impact of taxes on FDI is consistent with the negative association documented between large effective tax increases and FDI “market shares”, as well as with the majority of empirical studies summarized in de Mooij and Ederveen (2008).¹⁹

Table 5. The Impact of Effective Tax Rates on Private Investment

	(1) WG	(2) GMM	(3) WG	(4) GMM	(5) WG	(6) GMM
Private investment	0.631*** (0.053)	0.660*** (0.083)	0.629*** (0.054)	0.663*** (0.080)	0.443*** (0.118)	0.511** (0.238)
EMTR	-0.027 (0.016)	-0.015 (0.024)				
EATR			-0.076** (0.030)	-0.099* (0.057)	-0.070 (0.064)	-0.129 (0.147)
EATR for special regime					-0.039 (0.051)	0.191 (0.120)
Inflation	-0.236 (0.155)	0.209 (0.937)	-0.185 (0.156)	0.233 (0.811)	-0.884 (2.133)	-4.278 (5.589)
Financial openness	0.002 (0.003)	0.003 (0.002)	0.002 (0.003)	0.002 (0.002)	0.011** (0.005)	-0.003 (0.014)
Growth	0.067 (0.113)	0.119 (0.091)	0.063 (0.115)	0.110 (0.091)	0.197*** (0.049)	0.238* (0.128)
USD GDP, trillions	0.028*** (0.006)	0.009 (0.007)	0.027*** (0.006)	0.011* (0.006)	0.038*** (0.008)	0.021* (0.012)
Observations	461	461	461	461	233	233
Countries	44	44	44	44	27	27
R2	0.459		0.463		0.415	
Adj. R2	0.452		0.456		0.396	
AR(2) test		0.180		0.169		0.292
Hansen over.		0.0815		0.226		0.490

Notes: Dependent variable: private investment as a share of GDP. All explanatory variables are lagged by one year. Cluster-robust standard errors in parentheses. Stars indicate level of significance: ***: 1 percent, **: 5 percent, *: 10 percent. WG indicates regressions with country fixed effects. GMM indicates the Blundell-Bond system GMM estimator using the third to fourth lags of variables as instruments, with a collapsed instrument matrix. "AR(2) test" and "Hansen over." show the p-values of the Arellano-Bond test of second-order serial correlation and the Hansen test of overidentifying restrictions.

¹⁹ However, it is at odds with evidence reported in Mody (2007) on the weak sensitivity of U.S. multinationals' location decisions on host countries' corporate tax rates.

Table 6. The Impact of Effective Tax Rates on Foreign Direct Investment

	(1) WG	(2) GMM	(3) WG	(4) GMM	(5) WG	(6) GMM
FDI	0.561*** (0.106)	0.733*** (0.063)	0.554*** (0.106)	0.729*** (0.067)	0.229*** (0.082)	0.472** (0.189)
EMTR	-0.020 (0.012)	-0.012 (0.030)				
EATR			-0.062** (0.029)	-0.036 (0.076)	-0.022 (0.024)	-0.032 (0.081)
EATR for special regime					-0.014 (0.023)	-0.190* (0.100)
Inflation	-0.730*** (0.181)	-1.309 (1.378)	-0.687*** (0.191)	-1.373 (1.520)	3.624*** (1.238)	2.135 (3.411)
Financial openness	0.004 (0.004)	-0.003 (0.008)	0.003 (0.004)	-0.003 (0.007)	0.002 (0.006)	0.017 (0.011)
Growth	-0.118 (0.133)	-0.164* (0.091)	-0.122 (0.134)	-0.172* (0.095)	0.044 (0.047)	0.188 (0.131)
USD GDP, trillions	0.012 (0.007)	0.004 (0.007)	0.011 (0.007)	0.005 (0.007)	0.006 (0.004)	-0.013 (0.010)
Observations	499	499	499	499	254	254
Countries	47	47	47	47	29	29
R2	0.306		0.308		0.0994	
Adj. R2	0.297		0.300		0.0738	
AR(2) test		0.651		0.646		0.851
Hansen over.		0.868		0.380		0.563

Notes: Dependent variable: FDI as a share of GDP. All explanatory variables are lagged by one year. Cluster-robust standard errors in parentheses. Stars indicate level of significance: ***: 1 percent, **: 5 percent, *: 10 percent. WG indicates regressions with country fixed effects. GMM indicates the Blundell-Bond system GMM estimator using the third to fourth lags of variables as instruments, with a collapsed instrument matrix. "AR(2) test" and "Hansen over." show the p-values of the Arellano-Bond test of second-order serial correlation and the Hansen test of overidentifying restrictions.

V. CONCLUDING REMARKS

This paper has looked at corporate income tax systems in emerging and developing economies from various angles and, crucially, has studied the motivation for and the revenue and investment impact of changes in corporate tax policy. Specifically, our key findings are as follows:

- Corporate income tax systems in emerging and developing economies have, in general, developed in a similar fashion as in advanced economies: tax rates (statutory and effective) were cut, while bases were kept stable or broadened. There are some regional differences, with sub-Saharan Africa the most notable outlier, where the tax base was on average narrowed. Another difference compared to advanced economies is the widespread use of tax incentives granted under special regimes, which has brought effective tax rates close to zero in many countries.
- Despite the tax cuts that occurred, tax revenues held up well – even better than in advanced economies. Although high revenue levels at the end of the observation period are likely to have been favorably impacted by the cycle, trends over longer

time horizons do not lend themselves to an interpretation of weakening, let alone collapsing, revenues.

- The study of 90 large EATR and EMTR changes suggests that large tax increases occur against a backdrop of low revenues and comfortable levels of FDI, while low domestic investment provides the context for large tax reductions. Interestingly, statutory rate reductions account for most EATR and EMTR declines, but not increases, which were implemented by tightening other aspects of the tax system: investment allowances, depreciation provisions, etc. Large tax increases (decreases) have typically been associated with contemporaneous increases (decreases) in revenues and domestic investment, but declining (increasing) inward FDI as well as market share in inward FDI to a region.
- Revenues remain a positive function of tax rates, although this relationship is weakened when special regimes are offered. In Africa this relationship breaks down entirely, be it because of particularly sensitive investment, or the irrelevance of the standard tax regime given the pervasiveness of special regimes.
- High tax rates, especially on rent-earning investment, reduce investment. This relationship, however, breaks down in the presence of special regimes.

These diverse findings rule out many simple, popular explanations of tax developments, be it either that tax competition destroys the tax capacity of countries or that tax rate cuts finance themselves through higher investment. Nevertheless, (at least) two parallel developments are supported by the findings in this paper.

- (i) Standard tax systems (i.e. tax rules applying under normal circumstances) in emerging and developing economies appear to develop in similar fashion as in advanced economies. Countries seem to be under pressure to reduce tax rates; and lowering tax rates has a negative impact on revenues, at least in the short term. Still, revenues have been kept stable over the periods analyzed. This was to a limited extent the result of typical base-broadening, such as reductions in depreciation allowances. But to a larger extent, this must have other explanations, and candidates include formalization of the economies; growth of the corporate sector and their profits; more advanced base-broadening that cannot be captured by our measure. Moreover, while we have found that reducing the tax rate also reduces tax revenues, the loss is likely smaller in the medium to long-term, as a low tax rate encourages investment.
- (ii) At the same time, special regimes which reduce effective tax rates to close to zero remain widespread. In countries where these are present, the normal relationships break down. Increasing tax rates does not boost revenues, not even in the short term. The most likely explanation is that profits then shift to the special regimes, either because investment takes place there, or through some profit transfer scheme. In those countries investment cannot be encouraged through lowering tax rates either. This is because any tax-sensitive investment probably already takes place only under the special regime, so that the standard tax rate becomes irrelevant.

To sum up, we found no evidence of a “race to the bottom” for standard tax systems or even a significant difference in the developments of tax systems in our sample compared to advanced economies (with the exception of sub-Saharan Africa). For special regimes, however, the “race to the bottom” has long taken place, with effective tax rates close to zero. Overall, the development can therefore be described as a “partial race to the bottom,” with countries competing with only part of their tax system. This finding is in line with theoretical arguments that countries may try to concentrate their competitive tax cuts only on mobile capital, maintaining higher taxes otherwise,²⁰ although it remains an open question whether countries are indeed successful at targeting the most mobile investment.

Future research could further investigate questions relating to special regimes, such as: what proportion of investment qualifies for special regimes, and how does this differ across countries? Do special regimes successfully target mobile investment or is much investment that would take place anyway shifted into such schemes? What are the short and long-term revenue implications of special regimes, and how do they depend on developments in competing countries? The main challenge in answering these questions will be obtaining the requisite data for analysis. This will need to take both elements of the tax law into account (and could use our suggested effective tax rates), but also information on how this is implemented in practice, as similar schemes on paper, may be widespread in one country and used sparingly in another, especially when decisions on granting schemes are not fully formalized.

²⁰ See Keen (2002), Janeba and Smart (2003), and Gugl and Zodrow (2006),

APPENDIX I. DERIVATION OF EFFECTIVE TAX RATES

Devereux and Griffith (2003) developed a measure of the effective average tax (EATR), which is defined as the ratio of the present discounted value of taxes over the present discounted value of the profit of a project in the absence of taxation. This measure includes the previously developed effective marginal tax rate (EMTR) as a special case, when the post-tax economic rent is exactly equal to zero.

The original derivation in the paper by Devereux and Griffith is calculated for a one period perturbation in the capital stock; i.e., they look at an investment of one unit of capital that is held for one year and then sold at its remaining value of $(1-\delta)(1+\pi)$, where δ is true economic depreciation and π is inflation. To be able to study tax holidays and other special regimes, which typically last longer than one period, we have adapted the framework to look at a permanent increase in the capital stock by one unit, which is slowly disinvested over time through depreciation. Returns to capital are tax free during the tax holiday and taxed thereafter. To facilitate comparisons, we use exactly the same notation as Devereux and Griffith.

The Devereux-Griffith EATR is defined as $EATR = \frac{R^* - R}{p/(1+r)}$, where R^* is the present discounted value of the economic rent earned in the absence of taxation, R is the same in the presence of taxation, p is the pre-tax profit (net of depreciation) and r is the real interest rate. Because we adapt this to an infinite investment horizon, the denominator needs to be changed to take account of profits in all future periods. We assume that the net return on capital remains constant at p , but that the capital stock declines yearly by the true economic depreciation rate:

$$EATR = \frac{R^* - R}{p/(r + \delta)} \quad (1)$$

The present discounted value of the economic rent must be equivalent to the change in the value (V) of the firm:

$$R = dV_t = \sum_{s=0}^{\infty} \frac{\gamma dD_{t+s} - dN_{t+s}}{(1+\rho)^s}, \quad (2)$$

where D are dividends, $\gamma = (1 - m^d)/(1 - z)$ is a factor measuring the difference in treatment of new equity and distributions with m^d the personal tax on dividends and z the tax on capital gains, N stands for new equity issues and $\rho = (1 - m^i)i/(1 - z)$ is the investor's discount rate, with m^i the personal tax rate on interest and i the nominal interest rate. Dividends are determined by the usual flow of funds equation:

$$D_t = (p + \delta)(1 + \pi)K_{t-1}(1 - \tau) - I_t + B_t - (1 + i(1 - \tau))B_{t-1} + \tau\phi(I_t + K_{t-1}^T) + N_t, \quad (3)$$

where K is the capital stock, τ is the corporate tax rate, I is the investment undertaken, B is new debt issued, ϕ is the official depreciation allowance, and K^T is the tax-written-down value of capital.

Up to this point the derivation of R is identical to Devereux and Griffith. Now, instead of looking at a one period perturbation (i.e., $dI_t = 1$, $dI_{t+1} = -(1-\delta)(1+\pi)$), we look at a permanent investment (i.e., $dI_t = 1, dI_{t+s} = 0 \forall s \geq 1$). Using this assumption and substituting (3) into (2) the tax-free present discounted value of profits can be easily derived by setting all taxes to zero:

$$R^* = -1 + \frac{(1+\pi)(p+\delta)}{1+i} \left(1 + \frac{(1+\pi)(1-\delta)}{1+i} + \left(\frac{(1+\pi)(1-\delta)}{1+i} \right)^2 + \dots \right) = \frac{p-r}{r+\delta}, \quad (4)$$

In the presence of taxation the derivation is more complicated. We start by assuming that the investment is financed by retained earnings (i.e., $B = N = 0$), which yields in a first step:

$$R = \gamma \left(\sum_{s=1}^{\infty} \frac{(p+\delta)(1-\tau)(1+\pi)^s (1-\delta)^{s-1}}{(1+\rho)^s} - \sum_{s=0}^{\infty} \frac{dI_{t+s}}{(1+\rho)^s} + \tau\phi \sum_{s=0}^{\infty} \frac{dI_{t+s} + dK_{t-1+s}^T}{(1+\rho)^s} \right) \quad (5)$$

We now turn to the three sums within equation(5). The second sum is the simplest and is independent of any special regime:

$$\sum \frac{dI_{t+s}}{(1+\rho)^s} = 1 \quad (6)$$

In calculating the first sum, we need to take account of any special regime lasting Y years, during which the tax rate is τ' which is different from the standard one (and is zero in case of a tax holiday). For illustration we present only change in the tax rate here, but the program we use to calculate effective tax rates accommodates up to three changes.

$$\begin{aligned} & \sum_{s=1}^Y \frac{(p+\delta)(1-\tau')(1+\pi)^s (1-\delta)^{s-1}}{(1+\rho)^s} + \sum_{s=Y+1}^{\infty} \frac{(p+\delta)(1-\tau)(1+\pi)^s (1-\delta)^{s-1}}{(1+\rho)^s} \\ &= \sum_{s=1}^{\infty} \frac{(p+\delta)(1+\pi)^s (1-\delta)^{s-1}}{(1+\rho)^s} - \tau' \sum_{s=1}^Y \frac{(p+\delta)(1+\pi)^s (1-\delta)^{s-1}}{(1+\rho)^s} - \tau \sum_{s=Y+1}^{\infty} \frac{(p+\delta)(1+\pi)^s (1-\delta)^{s-1}}{(1+\rho)^s} \quad (7) \\ &= \frac{(p+\delta)(1+\pi)}{\rho-\pi+\delta(1+\pi)} \left(1 - \tau' - (\tau - \tau') \left(\frac{(1-\delta)(1+\pi)}{1+\rho} \right)^Y \right) \end{aligned}$$

The third sum, represents the present discounted value of depreciation allowances, which we label A . The calculation of this will depend on the depreciation rules.²¹ Putting this all together, and allowing for an additional effect F to account for the as yet ignored financial effects we obtain:

$$R = \gamma \left(\frac{(p + \delta)(1 + \pi)}{\rho - \pi + \delta(1 + \pi)} \left(1 - \tau' - (\tau - \tau') \left(\frac{(1 - \delta)(1 + \pi)}{1 + \rho} \right)^Y \right) - 1 + A \right) + F \quad (8)$$

The financial effects are similarly derived from equations (2) and (3). The amount of funds that needs to be raised to finance the investment is $(1 - \tau\phi)$, as there is already a depreciation allowance in the year of investment. Note that the tax rate in the year of raising the funds matters – hence this is τ' if a special regime is used (and the amount is simply 1 in case of a tax holiday with $\tau'=0$). The increase in new equity is assumed permanent, while debt is assumed to be repaid equivalent to the amount of nominal depreciation so that the debt-asset ratio is kept stable in the following years. Thus the financing for new equity is:

$$F^{NE} = \sum \frac{\gamma D_{t+s} - dN_{t+s}}{(1 + \rho)^s} = (\gamma - 1)(1 - \tau\phi) \quad (9)$$

For debt they are:

$$\begin{aligned} F^D &= \gamma(1 - \tau'\phi) + \gamma \frac{(1 - \delta)(1 + \pi)(1 - \tau'\phi) - (1 - i(1 - \tau'))(1 - \tau'\phi)}{1 + \rho} \\ &+ \gamma \frac{((1 - \delta)(1 + \pi))^2(1 - \tau'\phi) - (1 - i(1 - \tau'))(1 - \tau'\phi)(1 - \delta)(1 + \pi)}{(1 + \rho)^2} + \dots \\ &+ \gamma \frac{((1 - \delta)(1 + \pi))^Y(1 - \tau'\phi) - (1 - i(1 - \tau'))(1 - \tau'\phi)((1 - \delta)(1 + \pi))^{Y-1}}{(1 + \rho)^Y} + \dots \\ &= \gamma(1 - \tau'\phi) \left(\sum_{s=0}^{\infty} \left(\frac{(1 - \delta)(1 + \pi)}{1 + \rho} \right)^s - \frac{1 + i(1 - \tau')}{1 + \rho} \sum_{s=0}^{Y-1} \left(\frac{(1 - \delta)(1 + \pi)}{1 + \rho} \right)^s - \frac{1 + i(1 - \tau')}{1 + \rho} \sum_{s=Y}^{\infty} \left(\frac{(1 - \delta)(1 + \pi)}{1 + \rho} \right)^s \right) \\ &= \frac{\gamma(1 - \tau'\phi)}{\rho - \pi + \delta(1 + \pi)} (\rho - i(1 - \tau') + i(\tau - \tau')) \left(\frac{(1 - \delta)(1 + \pi)}{1 + \rho} \right)^Y \end{aligned} \quad (10)$$

²¹ For declining balance this would be: $A = \phi \frac{1 + \rho}{\rho + \phi} \left(\tau' + (\tau - \tau') \left(\frac{1 - \phi}{1 + \rho} \right)^Y \right)$ and for straight-line

depreciation: $A = \frac{\phi(1 + \rho)}{\rho} \left(\tau' + (\tau - \tau') \left(\frac{1}{1 + \rho} \right)^Y - \tau \left(\frac{1}{1 + \rho} \right)^{1/\phi} \right) \forall Y < \frac{1}{\phi}$. If methods are switched or

rates change, the formulae are more complicated. Up to three rate and method changes are taken into account in the program calculating the tax rates.

To calculate the EMTR, we need to set the post-tax economic rent R (equation (8)) equal to zero and solve for the required level of pre-tax net profit p . This yields:

$$\tilde{p} = \frac{(1 - A - F/\gamma)(\rho - \pi + \delta(1 + \pi))}{(1 + \pi) \left(1 - \tau' - (\tau - \tau') \left(\frac{(1 - \delta)(1 + \pi)}{1 + \rho} \right)^Y \right)} - \delta \quad (11)$$

The EMTR can then be calculated by obtaining R^* for \tilde{p} and substituting into (1) or equivalently as:

$$\text{EMTR} = \frac{\tilde{p} - r}{\tilde{p}}. \quad (12)$$

APPENDIX II. DATA SOURCES AND ASSUMPTIONS

The total tax and corporate tax revenue data was obtained from IMF country desks. For comparability purposes, social security revenue and, for oil producing countries, oil revenues, were excluded from both corporate and total taxes. In the case of oil producers, non-oil taxes were scaled to non-oil GDP.

Gross operating surplus was sourced from the United Nations (accessed from: <http://unstats.un.org/unsd/databases.htm>)

All other macroeconomic variables are from the World Economic Outlook database.

Information on statutory corporate income tax rates, depreciation regimes, investment allowances, and special regimes, were all sourced from the *Corporate Tax Guides* published by Price Waterhouse Coopers and Ernst and Young during 1996 and 2007. Some assumptions were needed during the extraction of this data, which are as follows:

- In cases where the size of a tax allowance depended on the extent of foreign partnership, a level of partnership delivering the higher tax allowance was assumed.
- Where the tax guides did not specify the depreciation method, or allowed firms to choose between straight line and reducing balance, the former was assumed.
- In cases where the duration over which assets are to be depreciated was not mentioned, 10 years was assumed for plant and machinery and 20 years for buildings (when a range was provided, an average was taken).
- Data was not assembled on incentives for investments in backward areas, research and development or production with high technology content.
- In some cases, incentives were provided on reinvestment of income. We ignored these, so that the derived rates represent what would apply to fresh investments.
- To adjust for different fiscal years, the tax rate applicable to the larger part of the financial year was taken as the tax rate for that year.
- Although we assembled depreciation rates (and calculated corresponding effective tax rates) for “building” as well, we are only reporting the effective tax rates applying to manufacturing firms investing in “plants and machinery”.
- Effective tax rates were calculated at the corporate level (i.e., ignoring personal taxes on dividends, interest and capital gains).

APPENDIX III. EPISODES OF LARGE EFFECTIVE TAX RATE CHANGES (1996-2007)
(In percentage points)

Effective Average Corporate Tax Rates						Effective Marginal Corporate Tax Rates					
	Start		Start	End		Start		Start	End		
Large increases	year	Duration	Size	level	level	Large increases	year	Duration	Size	level	level
Ecuador	2000	1	23.7	0.0	23.7	Romania	1998	1	34.6	-4.5	30.0
Uruguay	2002	1	16.1	17.0	33.2	Latvia	2001	5	28.0	-22.3	5.7
Sri Lanka	2003	4	12.2	18.4	30.6	Uruguay	2002	1	27.1	5.5	32.5
Vietnam	2001	4	11.9	21.4	33.3	Egypt	2001	1	23.5	10.9	34.4
Egypt	2001	1	11.6	24.6	36.2	Ecuador	2000	1	23.0	0.0	23.0
Pakistan	1999	1	8.1	27.9	36.0	Sri Lanka	2003	4	22.6	6.1	28.7
Latvia	2005	1	6.7	3.4	10.1	Tanzania	2002	1	21.4	-23.6	-2.1
Peru	1998	1	6.2	22.2	28.4	Vietnam	2001	4	15.8	19.2	34.9
Tanzania	2002	1	5.9	8.3	14.3	Hong Kong SAR	1998	1	13.6	-13.6	0.0
Costa Rica	2002	1	5.7	28.4	34.1	Peru	1998	1	10.7	17.0	27.7
Hong Kong SAR	1998	5	5.5	3.2	8.8	Mauritius	2005	1	8.8	-2.6	6.2
Argentina	1996	3	4.7	28.4	33.2	Pakistan	1999	1	8.6	24.3	32.9
Ecuador	1997	1	4.7	19.0	23.7	Kazakhstan	1997	4	8.0	19.1	27.1
Kazakhstan	1997	4	4.7	23.3	28.0	Kenya	2002	1	7.0	0.0	7.0
Mauritius	2004	1	4.6	6.9	11.5	Ghana	1999	2	6.0	6.8	12.8
						Romania	2000	2	6.0	4.3	10.3
Average		2.0	8.8	16.8	25.7	Average		1.9	16.5	2.9	19.5
Median		1.0	6.2	19.0	28.4	Median		1.0	14.7	4.9	25.0
Large decreases	Start		Start	End		Large decreases	Start		Start	End	
	year	Duration	Size	level	level		year	Duration	Size	level	level
Ecuador	1998	1	23.7	23.7	0.0	Uganda	1997	1	60.0	23.8	-36.2
Romania	1997	3	21.8	36.0	14.2	Nigeria	2002	3	47.4	-22.6	-70.0
Egypt	2003	3	21.3	36.2	14.9	Colombia	2006	1	35.6	35.9	0.3
Uganda	1997	1	20.2	25.9	5.7	Tanzania	2000	1	20.4	-3.1	-23.6
Colombia	2006	1	19.4	36.5	17.1	Latvia	2000	1	32.6	10.3	-22.3
Paraguay	2005	2	19.0	28.4	9.5	Egypt	2003	3	23.4	34.4	11.0
Bulgaria	1996	6	18.5	29.6	11.1	Romania	1997	3	31.1	35.5	4.3
Pakistan	2001	5	14.3	36.0	21.7	Ecuador	1998	1	23.0	23.0	0.0
Latvia	2000	4	13.4	16.8	3.4	Uruguay	2000	1	22.3	27.7	5.5
Lithuania	1999	3	13.3	27.5	14.2	Pakistan	2001	5	21.4	32.9	11.5
India	1996	3	12.6	36.7	24.0	Bulgaria	1996	11	20.9	24.2	3.3
Azerbaijan	1998	8	12.5	27.6	15.1	Kenya	1998	3	20.1	20.1	0.0
Uruguay	2000	1	11.4	28.4	17.0	Czech Republic	1997	8	18.8	38.0	19.1
Tanzania	2000	1	5.6	13.9	8.3	Paraguay	2005	2	18.7	27.7	9.1
Kenya	1998	3	10.7	25.7	15.0	India	1996	3	16.9	33.6	16.8
Ukraine	2004	1	9.5	40.3	30.7	Poland	1997	4	16.2	38.8	22.6
Uruguay	2004	3	9.5	33.2	23.7	Azerbaijan	1998	8	15.9	25.5	9.5
Poland	2002	2	8.3	24.5	16.2	Lithuania	1999	3	13.1	26.8	13.7
Sri Lanka	1996	7	6.9	25.4	18.4	Zambia	2004	1	10.0	16.8	6.8
India	2001	5	6.6	27.2	20.6	India	2001	5	9.9	19.7	9.8
Ghana	2004	1	6.5	21.2	14.7	Uruguay	2004	3	9.5	32.5	23.0
Pakistan	1996	3	6.4	34.3	27.9	Ukraine	2004	1	9.2	41.9	32.7
Romania	2004	1	6.1	16.8	10.8	Sri Lanka	1996	7	8.8	14.9	6.1
Bulgaria	2004	3	6.2	12.7	6.5	Poland	2002	2	8.4	22.6	14.1
Costa Rica	2004	1	5.7	34.1	28.4	Mauritius	1996	9	8.3	5.7	-2.6
Israel	2004	3	5.2	26.6	21.5	Kenya	2003	1	7.0	7.0	0.0
Singapore	2000	6	5.0	16.4	11.3	Pakistan	1996	3	6.7	31.0	24.3
Ecuador	1996	1	4.7	23.7	19.0	South Africa	2002	4	6.2	17.0	10.9
Morocco	2006	1	4.7	33.2	28.4						
Zambia	2004	1	4.2	24.0	19.9						
Poland	1997	4	14.5	39.0	24.5						
Average		2.8	11.2	27.8	16.6	Average		3.5	19.4	22.9	3.6
Median		3.0	9.5	27.5	16.2	Median		3.0	17.8	24.8	7.9

Source: Authors' calculations (see Appendix I for raw data sources and Appendix II for methodology).

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