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Tax Revenues, Development, and the Fiscal Cost of Trade Liberalization, 1792-2006

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Abstract

This paper documents the fiscal cost of trade liberalization: the extent to which countries are able to recover the trade tax revenues lost from liberalizing trade by increasing tax revenues from other sources. Using a novel dataset on government revenues over the period 1792-2006 we compare the fiscal impact of trade liberalization in developing countries and in today's rich countries at earlier stages of development. We find that trade liberalization episodes led to larger and longer-lived decreases in total tax revenues in developing countries since the 1970s than in rich countries in the 19th and early 20th centuries. Half the developing countries in our sample experience a fall in total tax revenues that lasts more than ten years after an episode. Results are similar when we consider government expenditures, suggesting decreases in trade tax revenues negatively affect governments' capacity to provide public services in many developing countries.

1 Introduction

This paper documents the fiscal cost of trade liberalization: the extent to which countries are able to recover the trade tax revenues lost from liberalizing trade by increasing

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tax revenues from other sources. Our starting point is a puzzle in the recent evolution of tax revenues in developing countries: tax-to-GDP ratios have decreased in these countries since 1970, in contradiction with the so-called 'Wagner's Law'[1] which states that tax ratios increase over time and as countries become richer. Figure 1 presents the evolution of the share of total tax and trade tax revenues over GDP in high-income countries (hereafter HICs), middle-income countries (MICs) and low-income countries (LICs) since the 1970s. In the top panel (Figure 1a) we see that tax ratios decrease in both MICs and LICs. This is particularly striking over the period 1970-2000 during which they fall by over 2 GDP points on average in both country groups. HICs, in contrast, experience a continuous increase in tax ratios over time. The bottom panel (Figure 1b) offers a potential explanation for this fall in tax ratios. It shows the evolution of trade tax revenues in the three country groups. The decrease in the share of trade tax revenues over GDP in developing countries (MICs and LICs) is large enough to explain the observed fall in tax ratios in both country groups.

In this paper we investigate the relationship between changes in total and trade tax revenues in developing countries along two dimensions. First, we ask whether countries in which trade tax revenues decrease experience a contemporary fall in total tax revenues and, when they do, for how long the fall lasts. We call this fall the fiscal cost of trade liberalization. We consider whether this cost is more frequent in LICs and MICS than in HICs since 1970, as suggested by Figure 1. Second, we turn to the historical experience of today's developed countries to determine whether the fiscal cost of trade liberalization is specific to the context in which developing countries liberalized trade since 1970.

We construct a new dataset on tax revenues and government expenditures from a variety of historical and contemporary sources. For each of the 130 countries in our dataset we go as further back in time as possible: our dataset starts in 1792 for one country, covers 9 countries in the 19th century and 35 countries in the first half of the 20th century. It is to the best of our knowledge the most exhaustive dataset on tax revenues available to researchers.

We then develop and implement a method to identify episodes of trade liberalization and measure the contemporary change in total tax revenues. We use a fiscal definition of trade liberalization: we define a 'trade liberalization episode' by a large and prolonged fall in trade tax revenues over GDP.[2] We then study whether countries are able to

[1]This 'law' is named after German economist Adolph Wagner (1835-1917) who first analyzed the relationship between tax ratios and economic development.

[2]This definition of trade liberalization implies that we ignore episodes of trade liberalization that

replace the fall in trade tax revenues by an increase in other (domestic) tax revenues and argue that there is a fiscal cost of trade liberalization when total tax revenues fall after the start of the episode. We say that there is fiscal recovery once total tax revenues are back to their pre-episode level. Our method may capture decreases in trade tax revenues which are not the consequence of countries' opening to international trade so we investigate possible causes for each episode using data on tariff rates, trade volumes, exchanges rates and the history of countries' trade policies. We find that 70% of the episodes can be to linked to changes in trade policy, and that average tariff rates decrease by 7.2 percentage points on average during the episodes.

We find 140 episodes of trade liberalization. Trade taxes fall by more than 3 GDP percentage points on average during these episodes. Half of the countries that experience a trade liberalization episode have not recovered the lost tax revenues 5 years after the start of the episode and we never observe a fiscal recovery in over 25% of the countries. There are clear differences by level of development in the period since 1970. Rich countries which experience a trade liberalization episode never experience any fiscal cost whilst over 50% of developing countries do. Moreover nearly 40% of LICs (34% of MICs) are never observed recovering the lost trade tax revenues through other tax instruments. Turning to the historical (pre-1970) evidence we find that the fiscal cost of trade liberalization experienced by today's HICs at early levels of economic development is smaller and shorter-lived than the one experienced by developing countries since 1970. This cost is still larger in countries that were poorer at the start of the episode. Overall, episodes of trade liberalization are associated with larger decreases in tax revenues in poorer countries, particularly so since the 1970s.

Countries that do not recover the lost trade tax revenues through an increase in other taxes may nevertheless maintain their level of public spending through an increase in non-tax revenues. We look at the evolution of government expenditures during trade liberalization episodes to test whether this is the case. Slightly fewer countries experience a fall in government expenditures than a fall in total tax revenues during trade liberalization episodes, suggesting that the decrease in trade tax revenues is indeed compensated for by an increase in non-tax revenues in some countries. The overall patterns are however strikingly similar: over a third of developing countries are never observed recovering the lost government expenditures, and poorer countries are more likely to experience an expenditure cost of trade liberalization and never recover the

are due to decreases in prohibitive tariffs or non-tariff barriers. We return to this important distinction below.

lost government expenditure than rich countries, particularly since the 1970s.

Our results are robust to the choices made in defining a trade liberalization episode. In particular, we find very similar results when normalizing tax revenues by population instead of GDP (to avoid capturing potential changes in GDP due to trade liberalization) and when we exclude i) episodes which we cannot link to changes in trade policy, ii) episodes which are not associated with a high-enough decrease in tariff rates, or iii) episodes for which we observe an increase in tax revenues prior to the onset of the episode (suggesting they may have chosen to pre-empt the fall in trade taxes). Varying the thresholds used to define an episode similarly does not affect the results. In the last section of the paper we discuss why countries differ in their capacity to recover the lost trade tax revenues through increases in other sources of revenues. In particular, we try to assess whether the difference between the experience of today's developing countries and that of rich countries at earlier levels of development may be explained by the fact that the former liberalized trade before they had developed sufficient fiscal capacity to compensate for the lost revenues.

This paper is closely related to Baunsgaard and Keen (2010) who first identified the existence of a trade-off between tax revenues and trade liberalization. Using 32 years of panel data they estimate how domestic tax revenues react to changes in trade tax revenues in the short run. They, like us, find an incomplete replacement of lost trade tax revenues in LICs. We build on and complement their work in several ways. First, our method abstracts from short-term co-movements between domestic tax and trade tax revenues which may be unrelated to structural changes in countries' tax structures. We document a clear correlation between our episodes of trade liberalization and decreases in average tariff rates. We pay particular attention to the extent to which our conclusions are driven by our methodological choices and find that they are not. Second, our longer and more complete dataset allows us to generalize their results for today's developing countries to their complete fiscal history since independence. Third, we compare these results to the fiscal impact of trade liberalization in today's rich countries when they were at similar levels of development and elaborate on the difference between today's developing countries and the historical experience of rich countries to discuss potential explanations for the fiscal cost of trade liberalization. Finally, we consider indirect fiscal consequences of trade liberalization. Trade liberalization could have led to an increase in GDP, affecting tax-to-GDP ratios, and could have been accompanied by increases in development aid - we consider both possibilities by looking at the evolution of both GDP growth and government expenditures during

trade liberalization episodes.

Our results also speak to the literature explaining why tax levels and tax structures change as countries develop. Recent examples include the work by Besley and Persson (2009, 2013) in which countries' decisions to invest in fiscal capacity allows them to increase their tax ratios over time and to decrease their dependence on trade taxes. Others argue that as economies develop they undergo structural changes which make transactions easier to monitor and allow governments to rely less on less efficient but easier to levy taxes like taxes on trade (see e.g. Riezman and Slemrod, 1987; Aizenman, 1987; Kleven et al., 2015). These theories imply that countries will decrease trade taxes once they find themselves capable of levying domestic taxes but they cannot rationalize the fiscal cost of trade liberalization. We return to this literature when discussing possible explanations for our results. A smaller literature discusses the conditions under which revenue-neutral reforms replacing taxes on trade by domestic taxes such as the VAT will be optimal (Keen and Ligthart, 2002, 2005; Emran and Stiglitz, 2005). Our results show that the typical trade liberalization reform in developing countries since 1970 was not revenue-neutral but instead lead to a decrease in total revenues.

This paper contributes more generally to the growing literature on public finance and development (see for example Gordon and Li, 2009; Piketty and Qian, 2009; Olken and Singhal, 2011; Pomeranz, 2015; Best et al., 2015) by providing a new exhaustive dataset on the subject.[3] We assemble historical and contemporary data on tax revenues in a coherent way that allows for meaningful comparison across countries and over three centuries. We hope our dataset will be of use to researchers in this field by providing a historical perspective on how both tax ratios and tax structures change as countries develop.

The remainder of the paper is organized as follows. Section 2 describes the data used and presents descriptive statistics on taxation and development. Section 3 presents our method and results regarding the fiscal cost of trade liberalization. Section 4 discusses the results and section 5 concludes.

[3]See also de Paula and Scheinkman (2010); Carrillo et al. (2011); Kumler et al. (2015); Gadenne (2016); Gerard and Gonzaga (2013); Jensen (2015).

2 Data and descriptive statistics

2.1 Data

We combine data on total tax revenues and trade tax revenues from three different sources: Mitchell (2007)'s *International Historical Statistics*, the dataset constructed by Baunsgaard and Keen (2010) and the International Monetary Fund's *Government Finance Statistics* (GFS). We digitize the data in Mitchell (2007) who compiles information on governments revenues from different national sources for all countries from the earliest available date to 2006. The Baunsgaard and Keen (2010) dataset compiles revenue information provided by the IMF's periodic consultations with member countries on total and trade tax revenues in 117 countries over the period 1975-2006. The IMF's GFS dataset spans the period 1972-2006 and has more limited coverage than the other two sources.

Our aim is to detect and analyze changes in total and trade tax revenues within countries over time. We therefore combine these three datasets in a way that does not allow for within country 'jumps' in the series which could be due to changes in data sources. To do so, we determine which dataset contains the largest number of observations for each country and use only data from this source for each country, unless we see a clear continuity across sources.[4] When two data sources cover different and large periods of time for a country but have different information for the time period during which they overlap we create a separate 'country' identifier for each period to avoid confounding a change in the series due to a change in the source with a real change in tax revenues. Finally, there are some gaps in the series when data is not available. We do a linear interpolation when the gaps last less than three years. When the gaps are longer (typically during wars), we drop the years for which the data is missing and create another country identifier when the series start again. We obtain a total of 5,200 observations for 130 countries from 1792 to 2006. Most of the observations come from Mitchell (2007) (49% of the observations) and Baunsgaard and Keen (2010) (44%). The web Appendix describes the data in more detail. Table A lists the countries in our sample and the data sources used for every country.

We complement our analysis of tax revenues by using data on the share of govern-

[4]Formally, we say that there is continuity across sources if both sources have the same information for the years on which they overlap and/or there is less than a 1 GDP point difference in the total tax and trade tax series across sources. This threshold was chosen to ensure that no change in data sources could be mistaken for the start of an episode as defined below.

ment expenditures in GDPs. We use the same source for our expenditure variable as for our tax variables whenever possible. Information on expenditures is available from Mitchell (2007) for most of the observations for which there is also tax information from this source. The dataset compiled by Baunsgaard and Keen (2010) however contains no information on expenditures and the GFS dataset very little information. We therefore use the IMF's *World Economic Outlook* (WEO) database to complement our dataset. We obtain information on the share of government expenditure in GDP for 5,036 observations for 128 countries, 54% of which from Mitchell (2007), 40% from the WEO database and 6% from GFS.

We use the GDP per capita data constructed by Maddison (2008) to classify countries by level of development. GDP is measured in 1990 Geary–Khamis dollars and is available for all countries for our period of interest. We classify countries by income group following the earliest available country classification from the World Bank (1987).[5] Based on this classification we say that a country is a high-income country (HIC) when its GDP per capita is above 8,000 dollars, a low-income country (LIC) when its GDP is below 2,000 dollars and a middle-income country (MIC) in between. The United States for example is a LIC until 1856, a MIC until 1941 and a HIC after that. We sometimes classify countries with respect to their GDP in 2006. When we refer to 'today's developing countries' we include all countries that are a LIC or a MIC in 2006. Classifying countries with respect to their 2006 GDP per capita our dataset includes 41 LICs, 49 MICs and 40 HICs. Countries are listed by their 2006 country group in the web Appendix Table A.

Finally, we use data on countries' trade policies and macro-economic situations to investigate whether the episodes we identify can be linked to trade liberalization policies. We use data on average tariff rates from Clemens and Williamson (2004) which provide annual data from 1865 to 1999, and complement it with information from the United Nations' *Statistical Yearbook* and the World Bank's *World Development Indicators*. Average tariff rates are defined as the total revenue from import duties divided by the value of total imports in the same year. Data on trade volumes and exchange rates comes from the *World Development Indicators*. Information on the dates of entry of the different countries in our sample in regional and international trade agreements is obtained from the World Trade Organization and its Regional Trade Agreements

[5]The World's Bank 1987 country classification uses a GDP concept that is slightly different from the one used in Maddison (2008). We choose the GDP per capita thresholds that most closely match the World Bank's classification in 1987 in our dataset.

Information System. Finally we collect information on the historical trade policy of countries from various volumes of the *Cambridge Economics Histories*.

2.2 Descriptive statistics

Table 1 shows the evolution of total and trade tax revenues as a share of GDP, GDP per capita and tariff rates since the 1830s for countries that are HICs, MICs or LICs in 2006. It highlights several stylized facts of interest regarding taxation and development. First, we see that tax-to-GDP ratios (hereafter tax ratios) increase with GDP per capita, in line with Wagner's Law. This is particularly evident in column 1 depicting the evolution of tax ratios for today's HICs. In the 1830s, the two countries for which data is available (the UK and the US) are what we would today call LICs and levy less than 7% of their GDP in taxes. Tax ratios then increase in the second half of the 19th century to 9% as countries become MICs and keep increasing by roughly 4-5 GDP points every twenty years until today. The trend of the first half of the 20th century, well-documented and often explained by higher demand for public spending during wars (see for example Lindert, 2004), is maintained in the second half of the century. These findings are robust to considering only countries for which data is available from the 1890s to the 1990s, as shown in the web Appendix Table B.1. The cross-sectional comparison between HICs, MICs and LICs in 2000-2006 also shows a positive, albeit weaker, correlation between economic development and tax ratios. HICs are today on average 16 times richer than LICs and levy twice as much taxes as a share of GDP.

Table 1 also illustrates a lesser-known stylized fact about taxation and development, the 'tax transition'. Countries at an early stage of development rely on taxes on trade to levy a large share of their revenues, as they develop this share becomes smaller.[6] Trade taxes represent nearly 50% of total taxes on average in the HICs we observe in the 1830s. This share falls to 18% in the 1920s, 12% in the 1950s and decreases in the last 50 years to around 2% today. We observe a similar decrease in the share of trade taxes in total taxes in developing countries, where trade taxes represent more than 25% (MICs) and nearly 40% (LICs) of total taxes in the 1970s. This share decreases to less than 15% (22% for LICs) in the 2000s. The correlation between the share of trade taxes in total tax revenues and development also holds in the cross-section: in 2000-2006, the share of trade taxes in total tax revenues is ten times bigger in LICs than in HICs. We see a similar pattern when looking at average tariff rates: in 2000-2006, tariffs are more

[6]This stylized fact was first documented by Hinrichs (1966).

than six times higher in LICs than in HICs.

Interestingly the tax transition took a different form in today's HICs compared to developing countries. In HICs the decrease in the share of trade taxes in total taxes is mostly due to an increase in non-trade tax revenues: from 1860 to 1980 the share of trade taxes in GDP remains roughly constant while the tax ratio strongly increases. The share of trade taxes in GDP only clearly decreases from 1980 to 2006 – in parallel with a sharp decrease in tariffs –, a period during which trade taxes already represent a negligible share of total revenues. In developing countries on the contrary the tax transition is driven by a decrease in the share of trade taxes over GDP, starting from a higher level, more than by an increase in tax ratios.

Changes in the number of countries in each group may lead to spurious changes in average values over time. Focusing on the recent period during which more data for developing countries is available we see a similar pattern when we only consider the 87 countries for which we have data in each decade from 1970 to 2006 (Table 2). As discussed in the introduction tax ratios have decreased in both MICs and LICs during the 1980s and 1990s, they fall by 2 GDP points in LICs over the period. The share of trade taxes in GDP falls by nearly half in all country groups. This fall is more than enough to explain the decrease in total tax ratios over time in MICs and LICs but does not halt the increase in tax ratios in HICs.[7]

3 The fiscal cost of trade liberalization

3.1 Method

We use a fiscal definition of trade liberalization: we define trade liberalization episodes by a fall in trade tax revenues as a percentage of GDP of at least 1 GDP point from a local maximum to the next local minimum.[8] Ratios of tax revenues to GDP experience short-run fluctuations, some of them very large, that may come from exchange rate volatility, changes in the reporting period or business cycles and be unrelated to change in tax policy. We isolate the trends in our data on total tax, trade tax and expenditure

[7]Part of the very large increase in tax ratios in HICs is due to changes in the data sources used over time. Our educated guess from comparing our data to official numbers released by countries' statistical institutes is that social security contributions are not included in the Mitchell (2007) data but they are in the Baunsgaard and Keen (2010) data - see the web Appendix for a discussion of this issue. Web Appendix Table B.2 shows that the increase is smaller when we use only data from Baunsgaard and Keen (2010).

[8]We say that an observation is a local maximum (minimum) if it is higher (lower) than the preceding and following observations.

as a share of GDP to avoid confounding episodes of trade liberalization with short-run correlations. Our main method uses the Hodrick-Prescott filter; we follow Ravn and Uhlig (2002) in using a 6.25 smoothing parameter[9]. We define the *size* of an episode by the difference between the local maximum value of trade tax revenues as a percentage of GDP at the start of the episode (year s) and the following local minimum value of trade tax revenues at the end of the episode (year e). The distance between year e and year s is the *length* of the episode.

We measure the potential fiscal cost of trade liberalization by looking at the evolution of total tax revenues as a percentage of GDP. By definition, total tax revenues are expected to fall during an episode unless countries are able to increase their tax collection from other (domestic) sources of tax revenues by an amount large enough to compensate for the fall in trade tax revenues. In the absence of such an increase, we say that countries experience a fiscal cost of trade liberalization. More precisely we measure for each episode of decrease in trade tax revenues (i) whether total tax revenues as a share of GDP fall at the start of the episode; and (ii) if they do, the number of years before total tax revenues come back to their level before the start of the episode. Formally, we define the *revenue recovery* year (r) as the first year in which total tax revenues as a percentage of GDP are at least equal to their value in year s. We call the distance between year r and year s the (fiscal) *recovery time*.

Figure 2 illustrates graphically how we construct the episodes, the fiscal cost and the fiscal recovery variables using the example of Guatemala for which we have data over the period 1972-2004. The vertical red line shows the start of the episode, the blue line its end and the green line the year of recovery. The episode starts in 1978, lasts six years and has a size of 2.4 GDP points. We observe a fiscal recovery after 23 years.

Trade liberalization is not the only possible explanation for the decreases in trade tax revenues we observe. They could also be the consequence of a fall in trade volumes, a shock to the exchange rate or a major destructive event that leads to a collapse in both trade and domestic tax collection. We use data on average tariff rates, trade volumes, exchange rates and dates of entry in regional and international trade agreements to identify potential explanations for the episodes. We argue that episodes which start during or just before a free trade agreement or which are contemporary to large decreases in average tariff rates are episodes that are likely due to trade liberalization.[10]

[9]This corresponds to a value of 1600 for quarterly data. Ravn and Uhlig (2002) show that the smoothing parameter should be adjusted according to the fourth power of a change in the frequency of observations.

[10]More precisely, we associate an episode with a free-trade agreement if it occurs 3 years before or

Our example of Guatemala in 1978 counts as one such episode: the average tariff rate fell by 30% between 1978 and 1982.

Our analysis defines trade liberalization episodes by decreases in trade tax revenues. This is justified by our interest in the fiscal consequences of trade liberalization: if trade tax revenues do not decrease during an episode there will by definition be no fiscal cost. But it likely leads us to ignore a number of trade liberalization experiences which do not lead to a decrease in trade tax revenues. A decrease in prohibitive tariffs for example could lead to an increase in trade tax revenues; if countries experienced a large number of such decreases we could be missing an important aspect of trade liberalization. We use an alternative definition of episodes based on decreases in tariff rates to assess whether this is the case. The tariff data starts later (1865), is available for less countries (109) and even for these countries since 1865 the data is less complete than the tax data so we have tariff information for only 59% of our observations. Defining an episode by a fall in tariffs of at least 3 percentage points we obtain 73 episodes.[11] Close to 60% of those overlap with episodes obtained using our baseline (fiscal) definition of an episode, and most of the remaining episodes are accompanied by a decrease in trade tax revenues, albeit smaller than 1 percentage point.[12] Only 7 episodes are accompanied by a small increase in trade tax revenues. There are therefore few cases of decreases in tariffs that did not lead to at least a small decrease in trade tax revenues but several episodes of decreases in tariffs that we do not consider as 'episodes of trade liberalization' using our baseline definition. We should therefore interpret our results in what follows as relevant regarding trade liberalization defined as a decrease in trade tax revenues, and not regarding all possible forms of trade liberalization.[13] We list episodes obtained using this method and whether or not they overlap with a baseline episode in web Appendix Table B.

Finally, categorizing a decrease in total tax revenues after the start of an episode as a 'fiscal cost of trade liberalization' is not appropriate if the decrease in trade tax revenues has been pre-empted. Countries may decide to increase tax revenues from

after the agreement. This is to take into account the fact that our smoothing method may lead us to measure the precise onset of the episode with error.

[11]We use the same method to define these episodes, ie start by applying an HP filter to our tariff data and compare local maxima and minima.

[12]We say that there is an overlap if an episode obtained using our baseline definition starts between the start and the end of the episode, or if the episode starts between the start and the end of a baseline episode. The share of episodes that overlap with baseline episodes is similar if we define episodes by a 5 percentage points decrease (63% overlap) or a 1 percentage points decrease (54% overlap).

[13]Note that we are unable to document trade liberalization episodes driven by the removal of non-tariff barriers but there is a priori no reason to expect these to lead to a loss in tax revenues.

domestic sources before lowering tariffs precisely to counterbalance for the coming fall in trade tax revenues. The level of domestic tax revenues we observe at the start of the episode would then already compensate for the loss in trade tax revenues during the episode. We consider the evolution of domestic tax revenues in the years prior to the start of the episode to investigate whether such pre-emptive measures occur.

3.2 Results: Trade liberalization episodes

We find 140 episodes of decreases in trade tax revenues. Table A in the web Appendix lists the countries in which episodes occur, episode start dates, and possible explanations for the decrease in trade tax revenues. We find that nearly 70% of the episodes can be traced back to some form of trade liberalization policy (a trade agreement, a fall in tariffs or a documented change in trade policy). Another 11% are contemporary with a fall in trade and 6% with an exchange rate shock. A few episodes could be the consequence of wars or natural disasters and we cannot find an explanation for 12 episodes.

Table 3 presents descriptive statistics on our sample of episodes. We consider separately the pre- and post-1970 periods and countries that were HICs, MICs and LICs at the start of the episode to investigate whether today's developing countries experienced a different fiscal cost of trade liberalization from today's HICs when they decreased trade tax revenues in the 19th and early 20th centuries.[14] We report the total number of observations available in our dataset for the period and country groups under consideration to consider whether episodes are more likely in some periods and groups. Our main focus is on the comparison between the trade liberalization experiences of today's developing countries and i) that of rich countries since 1970s, and ii) that of rich countries at earlier stages of development, ie developing countries in the pre-1970s period. We therefore present in all the following tables and for each variable the two-sided p-value of the differences between i) developing countries (MICs and LICs) and rich countries in the post 1970s – column 10 in Tables 3 to 7 ii) the pre and post 1970s periods for developing countries – column 11 in Tables 3 to 7.

The average loss in tax revenues due to an episode is large: trade tax revenues fall on average by 3.2 GDP points during the episode (column 1). This fall represents 58% of the average trade tax revenues and 19% of total tax revenues at the start of the episode. There is a contemporary 7.2 percentage points decrease in tariff rates during

[14]The choice of the 1970 year to split our sample is driven by the fact that for the majority of developing countries in our sample, data only becomes available a few years after independence.

episodes for which we have tariff data and the typical episode lasts 12 years. There is a small increase in the frequency of episodes in the recent period compared to the pre-1970 period (3 episodes for 100 observations versus 2 episodes for 100 observations prior to 1970) despite its much shorter time span. Episodes are also significantly deeper (bigger sizes spread out over shorter periods) since 1970.[15] Turning to differences by income group at the start of the episode we see that poorer countries are much more likely to experience episodes since 1970: there are 0.3 episodes per 100 observations among HICs, 3.6 among MICs and 4.6 among LICs. They also have significantly lower total tax to GDP ratios and experience slightly deeper episodes though the difference is not statistically significant.

The penultimate line of Table 3 presents the share of countries in which total tax revenues increase in the 3 years prior to the episode by at least as much as the size of the episode. We see that on average few countries – 6.5% – preempt the loss in trade tax revenues (column 1). This share is much higher among countries that are HICs at the start of the episode; in particular all the rich countries in which there is an episode after 1970 also experience increases in tax revenues prior to the episode that more than compensate for the loss in trade taxes. Excluding these episodes from our sample does not change the overall picture in Table 3 (see web Appendix Table B.3).[16]

Table 4 presents descriptive statistics for the 96 episodes that we can associate with a change in trade policy. These episodes are associated with larger decreases in average tariff rates, as expected, but are otherwise very similar to the average episodes in Table 3.[17] Web Appendix Table B.4 presents similar statistics restricting the sample to episodes contemporaneous with a large decrease in average tariffs (at least 7 percentage points); the overall patterns stay unaffected. On the whole these tables indicate that in the post 1970 period countries are more likely to experience episodes of decrease in trade tax revenues at earlier stages of economic development.

[15]The largest episode occurs in Ghana and starts in 1985: trade tax revenues fall by 13 GDP points during that episode. The longest episode occurs in Pakistan, starts in 1974 and lasts 31 years.

[16]We take a conservative definition of 'non pre-empted episodes' and only keep episodes for which we have data 3 years prior to the episodes and there is no increase in tax revenues before the episode that is at least as big as the episode itself. This leaves us with 86 episodes.

[17]The differences between rich and developing countries since 1970 and developing countries pre and post 1970 are less likely to be statistically significant in this sample than in our baseline sample of episodes in Table 3, as expected given the 40% decrease in the number of episodes.

3.3 Results: Fiscal cost of trade liberalization

Table 5 presents our measure of the fiscal cost of trade liberalization. We find several patterns of interest.

First, developing countries experience a fiscal cost of trade liberalization more often than rich countries. The first line of the table presents the share of countries for which we do not observe any fall in total tax revenues at the start of an episode: in these countries trade tax revenues fall but domestic sources of tax revenues increase more than enough to compensate this fall. This occurs for nearly half of the episodes and more often in the pre-1970 period than in the recent period, though the difference is not statistically significant. Developing countries are more than twice as likely as rich countries to experience a fall in total tax revenues in the recent period. None of the HICs for which we see an episode after 1970 also experience a fiscal cost of trade liberalization, while more than 50% of the MICs and 60% of the LICs do.

Second, roughly one-fourth of the countries are never observed going back to their pre-episode level of tax revenues – we say that they experience no fiscal recovery. This is more likely in the recent period – the p-value for the difference across periods for all country groups, not shown in the Table, is 0.01 – and again varies with economic development. All the HICs experience a fiscal recovery but over a third of the developing countries for which the episode starts after 1970 do not.

Third, the countries for which we observe both a fiscal cost and a fiscal recovery return to their pre-episode level of tax revenues slightly faster since 1970 than before 1970 (- see 'actual recovery time' in the third line of the Table). They do so on average 7 years after the start of the episode in the pre-1970 period and 4 years in the post-1970 period. Rich countries that recover also typically do so faster than developing countries in the post 1970 period, though the difference is not statistically significant.

The fact that countries that experience episodes since 1970 are less likely to recover fiscally but recover faster when they do suggests that part of the differences across periods may be due to data truncation. We observe countries for a smaller number of years in the post-1970 than in the pre-1970 period and may not have long enough time series after the most recent episodes to observe fiscal recoveries. Similarly, we could be observing less recovery in developing countries because data series are typically shorter for these countries than for HICs. We check that this is not what is driving our results by considering the number of years for which we observe countries in the data after the start of the episode (see 'potential recovery time', fourth line of the Table). This

number is indeed higher in the pre- than in the post-1970 period, but if anything poorer countries are observed for slightly longer after the start of the episodes. Results are moreover similar when we consider the probability of recovery amongst only countries which we observe for five, ten or twenty years after the start of the episode (see the last three lines of the Table). Regardless of the time period used we see developing countries recovering more in the pre- than in the post-1970 period (though differences are not always statistically significant); developing countries are significantly less likely to recover than HICs in the post-1970 period.

3.4 Results: Government expenditures

We do not attempt to discuss the potential net welfare gain or cost of trade liberalization here. On the one hand, the decrease in tax revenues associated with trade liberalization may be optimal given concerns about corruption levels in developing countries (on corruption see recent reviews by Olken and Pande, 2012; Banerjee et al., 2013). On the other hand, limited public resources could explain persistent differences in growth rates across countries (Aizenman and Jinjarak, 2007) and constrain developing countries' capacity to provide key public goods (Duflo, 2011). Even assuming that extra public resources are welfare increasing in these countries a fall in tax revenues is only costly if it leads to a decrease in public spending. If it is compensated for by an increase in other sources of revenues – development aid or revenues from natural resources for example – the main potential reason to worry about the fiscal cost of trade liberalization becomes moot. This is particularly meaningful in the post-1970 period given the importance that the 'aid for trade' paradigm has taken during this period. This paradigm advocates poverty alleviation via aid aimed at expanding export opportunities and domestic complementarities to trade (see for example Balat et al., 2009).[18] We therefore turn to data on the share of government expenditures to GDP and consider whether (i) government expenditures fall at the start of episodes and (ii) when they do, the number of years before government expenditures come back to their pre-episode level.

Table 6 presents our results regarding government expenditures. The shares of countries that experience a decrease in expenditures or are never observed to recover are slightly smaller than in Table 5 for most income and period groups, particularly for LICs. This suggests that non-tax sources of public revenues were sometimes used to compensate for the fall in trade taxes. The key patterns remain the same however:

[18] Younas and Bandyopadhyay (2007) present some evidence that some donors give more aid to developing countries that implement trade liberalization reforms.

today's developing countries are more likely than both rich countries and developing countries in the pre-1970s period to experience an expenditure cost and less likely to recover in five, ten or twenty years, though the differences between rich and developing countries since 1970 are not always statistically significant. Trade liberalization episodes lead to a fall in government expenditures that is permanent in our data 30% of the time in developing countries since 1970 whilst rich countries always recover the lost government expenditures.

3.5 Robustness checks

All the robustness check results in this sub-section are available in the paper's web Appendix unless specified otherwise.

Changes in trade policy only. Our definition of trade liberalization episodes could be overly sweeping. As explained above some of the episodes may have little to do with trade liberalization policies; the evolution of total tax revenues after these episodes should not be interpreted as reflecting the fiscal cost of trade liberalization. Table 7 replicates the results in Table 5 for the sample of episodes that we can associate with a change in trade policy. The share of developing countries making a full fiscal recovery in the medium-run (10 or 20 years after the end of the episode) is slightly higher than in Table 5, in line with the idea that some of the other episodes may be due to external shocks that affect both domestic and trade collection negatively. The main results – lower likelihood of recovery in developing countries, particularly since 1970 – remain however similar, and are unaffected if we consider the recovery in government expenditures instead of tax revenues in this sample (see web Appendix Table B.6).[19]

Changes in GDP growth. Results obtained using tax revenues (or expenditures) as a share of GDP may partially capture changes in GDP growth. This is a potential cause for concern here as trade liberalization may itself increase GDP (see e.g. Lee et al., 2004; Wacziarg and Welch, 2008).[20] Estimating the impact of trade liberalization

[19]Note that again the differences between groups of countries looses statistical significance due to the smaller sample of episodes considered. The pattern also remains the same if we restrict our sample to episodes associated with a cut in tariff rates of at least 7 percentage points (web Appendix Tables B.7 and B.8).

[20]Similarly, a large share of the economy in developing countries is informal and untaxed (Schneider and Enste, 2000); if the informal sector of the economy is partially captured in GDP data, faster growth in the informal than in the formal (taxed) sector would similarly lead us to observe a fall in tax-to-GDP ratios even if the lost trade tax revenues are recovered through increases in other taxes.

on economic growth is beyond the scope of this paper but we consider whether growth increases following an episode by computing the average growth rate before and after the start of episodes, using a number of different time spans (1, 3, 5 and 10 years). Table 8 presents the results. There is no evidence that episodes of trade liberalization were accompanied by increases in GDP growth rates.

We consider an alternative definition of episodes using data on tax revenues per capita to further address this concern: we abstract from using GDP data altogether and say there is an episode when we observe a large fall in (smoothed) trade tax revenues per capita and look for fiscal recovery of the total tax revenues per capita variable.[21] The results are again very similar to those obtained using tax data normalized by GDP. The difference between the pre- and post-1970 periods is even stronger as all countries which experience an episode prior to 1970 are observed making a fiscal recovery at some point in the sample period (see web Appendix Tables B.13 and B.19).

Alternative definitions of episodes. A final potential concern is that the method we use to define episodes may not get rid of all noisy short-run variations in tax revenues – in which case some of our episodes are spurious – or may get rid of too much variation, leading us to exclude informative episodes. We consider episodes defined using a higher (2 GDP points) threshold for the fall in trade tax revenues and check for the robustness of the results to the choice of filter by considering episodes obtained using different smoothing parameters for the HP filter.[22] A known concern with the HP filter is its 'end-point bias' (Baxter and King, 1999) as the last point of the series has an exaggerated impact on the trend. We use the Christiano-Fitzgerald band-pass filter to check that this bias is not driving some of our results (Christiano and Fitzgerald, 2003). Results are presented in Tables B.9 to B.12 and Tables B.15 to B.24 in the web Appendix. We obtain more episodes (169) when using the Christiano-Fitzgerald method and less episodes when using higher values of the HP filter (137 and 133 episodes) or a higher threshold for the definition of the episodes (84 episodes), as expected. The main patterns found in Tables 3 and 5 are however unaffected; the results on the fiscal and expenditure costs of trade liberalization are robust to using alternative definitions of what constitutes a trade liberalization episode. Our results are similarly unaffected if we only consider non pre-empted episodes - those for which we know that the fall in

[21] We choose a 50% threshold to obtain a number of episodes that is similar (112) to the one obtained using our main definition.

[22] We consider values of 8.25, as in Ravn and Uhlig (2002) and 10, as in Hassler et al. (1992) and Baxter and King (1999)

trade tax revenues was not compensated for 'ex-ante' by an increase in tax revenues (web Appendix Tables B.14 for tax revenues and B.20 for government expenditures).

Our findings therefore indicate that developing countries i) are more likely to experience a fiscal cost of trade liberalization, and ii) experience it for longer, than both rich countries today and rich countries when they were at similar stages of economic development. This suggests that the fall in tax ratios in these countries over the period 1970-2000 discussed in the introduction can at least partially be explained by the decrease in trade tax revenues observed in Figure 1. Moreover, we show that the fall in tax revenues during trade liberalization episodes in many developing countries is hardly compensated for by increases in other types of government revenues: we observe similar patterns when we consider the evolution of government expenditures after episodes. In the next section we elaborate on the difference between today's developing countries and the historical experience of rich countries to discuss potential explanations for the fiscal cost of trade liberalization that we observe.

4 Discussion

Why are some countries able to recover the lost tax revenues from liberalizing trade through domestic sources of taxation when others are not? To answer this question one must first understand why trade taxes are such an important tax handle for countries at an early stage of economic development. We have seen that they represent more than 30% of total tax revenues in LICs in the 1970s as well as in today's HICs in the 1830s. The consensus in the literature is that while the Diamond-Mirrlees (1971) production efficiency theorem implies that taxes on international trade are inferior to most forms of domestic taxation (for a review see Dixit, 1985), the former are easier to levy or more 'revenue-efficient' to follow the terminology in Best et al. (2015). Optimal tax theory therefore predicts that countries will only tax trade if they cannot raise sufficient revenues through taxes on domestic transactions. This may be the case in developing countries if economies at an early stage of development are intrinsically harder to tax – we know for example that agricultural incomes are hard to tax and that small firms are less likely to be tax compliant than large firms (Kleven et al., 2015). Relatedly, and following the concepts developed in Besley and Persson (2009, 2013), we can think that developing countries have less fiscal capacity and that less fiscal capacity is needed to levy trade taxes than broader-based domestic taxes: to levy tariffs governments only need to observe a few large transactions that are typically concentrated geographically.

These theories explain the tax transition observed in our data: as countries develop they decrease their revenues from taxes on trade and increase taxation from other sources. They are also consistent with historical evidence on rich countries which suggest that they gradually lowered tariffs once they had developed a fiscal administration which made it possible to raise tax revenues through other means (Ardant, 1972). A good example is one of the earliest episode in our sample, in 1842 in the United Kingdom - a low-income-country at the time. At this time over a third of the UK's tax revenues came from export and import duties. Prime minister Robert Peel implemented a large over-the-board decrease in tariffs, and financed the budget overhaul by re-introducing the income tax and mobilizing the country's modern tax bureaucracy built during the Napoleonic Wars - in other words by utilizing pre-existing fiscal capacity. The extra tax revenue raised was more than expected, allowing for further tariff reforms starting in 1846, the famous repeal of the Corn Laws (Bairoch, 1989). We observe immediate revenue recovery (no fiscal cost) for this episode.

These theories cannot however explain why we often observe a fiscal cost of trade liberalization in developing countries since 1970. On the contrary they predict that tax ratios will *increase* when tariffs decrease: as countries shift their tax mix away from inefficient taxes on trade (because of structural economic change or of increases in fiscal capacity) the marginal cost of raising taxes falls, leading to an increase in (optimal) tax ratios. To explain the decrease in tax ratios that we observe one therefore has to assume that trade taxes decrease for exogenous – non fiscal – reasons. Governments may wish to enter trade agreements regardless of their potential fiscal costs, or may be pressured to do so by international institutions or large trade partners. Antrás and Padró i Miquel (2011) argue for example that powerful governments often succeed in changing the tariff policies of their smaller trade partners, a situation that may well characterize the experience of many developing countries since the 1970s. This may have lead them to decrease taxes on trade 'too early' from a fiscal perspective, i.e. before they were in a position to increase revenues from domestic sources of taxation. This hypothesis suggests the fiscal cost may have been particularly severe for episodes that can be linked to a trade agreement. Results presented in the web Appendix (Table B.25) show that if anything these episodes are characterized by a slightly lower fiscal cost and faster recovery, though the differences with our baseline sample of episodes are not statistically significant. This does not however allow us to draw strong conclusions regarding the validity of this hypothesis as the pressure from trading partners to liberalize trade may occur outside of formal trade agreements and fundamentally cannot be observed.

An alternative explanation is that what we observe is the consequence of an optimal policy change: governments in developing countries may have chosen to simultaneously open up to trade and lower their tax ratios. This seems consistent with the fact that many of our episodes occur during the 1980s and 1990s, a period during which many developing countries implemented structural stabilization plans, often under the auspices of the IMF. Liberalizing trade and lowering government expenditures (considered 'too high' given these countries' levels of development) were often seen as steps towards stabilizing the economy (see International Monetary Fund, 2001; Easterly, 2003). To assess the plausibility of this hypothesis Table 9 presents descriptive statistics of developing countries that experienced episodes since 1970s at the start of the episode.[23] The first panel compares countries that experienced a fiscal cost to those that experienced no fiscal cost, the second restricts the sample to episodes for which there was a fiscal cost and compares countries that recovered under 10 years and those that did not. We see that countries that experienced a fiscal cost had slightly higher tax revenues at the start of the episode (though the difference is only significant at the 11% level) but were not significantly richer, suggesting their revenues may indeed have been thought of as 'too high' for their level of development. There is no evidence however that countries with higher tax revenues are also less likely to recover, conditional on experiencing a fiscal cost.

Finally, we consider one implication of the Besley and Persson (2009, 2013) model of investment in tax capacity which argues that countries are more likely to invest in tax capacity when they have more inclusive institutions. In our context this implies that countries with more inclusive institutions at the start of the episode are less likely to experience a fiscal cost (because they already have tax capacity they can mobilize to raise more revenues) and, if there is a fiscal cost, more likely to recover by investing in tax capacity. Following Besley and Persson (2009) we use the democracy index from the Polity IV dataset to proxy for the inclusiveness of political institutions and consider differences in the levels of democracy in the last rows of both panels.[24] The evidence does not contradict this hypothesis as countries that experience no fiscal cost or recover faster are indeed more democratic, but again the differences are not statistically significant.

[23]Data on structural adjustment plans is unfortunately not available.

[24]This index takes values going from -10 to +10, with higher values indicating more democratic institutions.

5 Conclusion

This paper shows that trade liberalization sometimes comes at a fiscal cost. Using a new panel dataset of tax revenues covering 130 developed and developing countries from 1792 to 2006, we characterize 140 episodes of decrease in trade tax revenues and consider the contemporary evolution of total tax revenues to investigate the potential fiscal cost of trade liberalization. We show that in the period since 1970 developing countries are more likely than rich countries to experience a fall in total tax revenues as they decrease trade taxes and less likely to recover the lost tax revenues through other sources of taxation. They are also more likely to experience a contemporaneous fall in total government expenditures. We observe similar episodes of decreases in trade tax revenues in today's rich countries when they were at earlier level of development in the 19th and early 20th centuries but find that they were less likely to experience a simultaneous decrease in total tax revenues than today's developing countries, and that when they did this decrease was smaller and shorter-lived. Trade liberalization, defined here as a decrease in trade tax revenues, seems to have come at a larger fiscal cost in today's developing countries; this may be because they decreased taxes on trade before having developed tax administrations capable of taxing domestic transactions on a large scale.

The fiscal cost of opening up to trade experienced by developing countries could be eroding support for further trade liberalization. Trade taxes still represent nearly one-fourth of total tax revenues in 2000-2006 in low-income countries. These are precisely the countries for which the international community calls for increases in domestic revenue mobilization (Sachs et al., 2005; Gupta and Tareq, 2008; OECD, 2010). Our findings suggest that increasing these countries' capacity to tax could weaken one of the reasons they are reluctant to embrace free trade by making governments less dependent on taxes on trade for public revenues.

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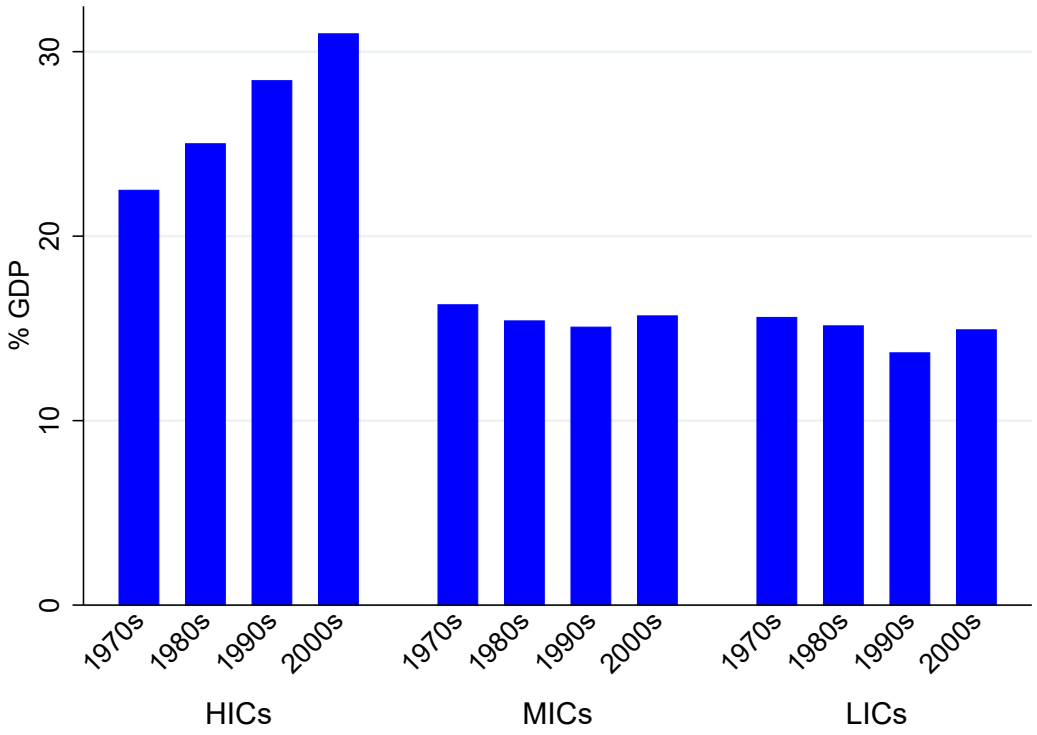
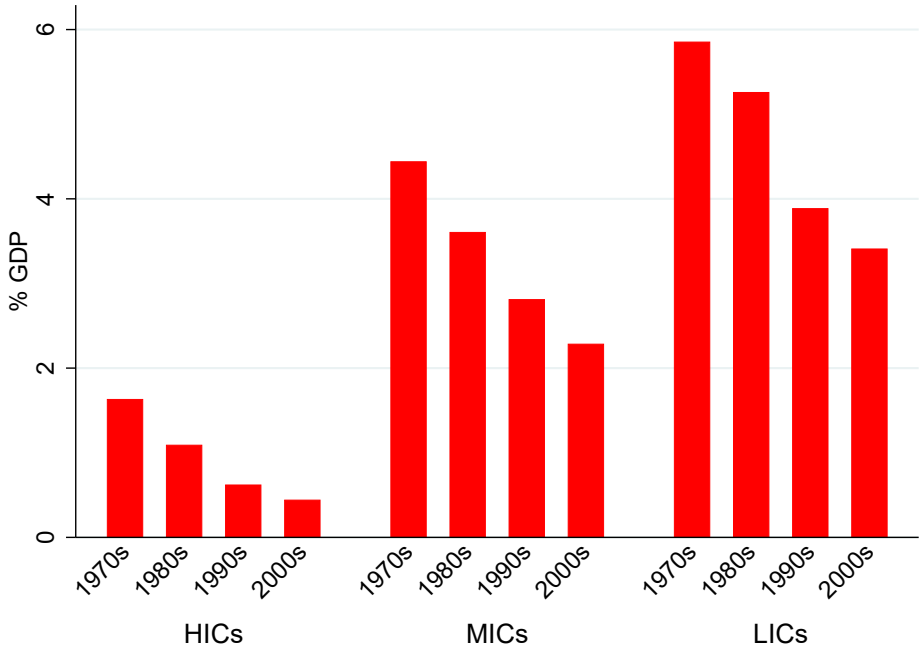
Figure 1: Evolution of total and trade tax revenues since 1970 by level of development

(a) **Total Tax Revenues**

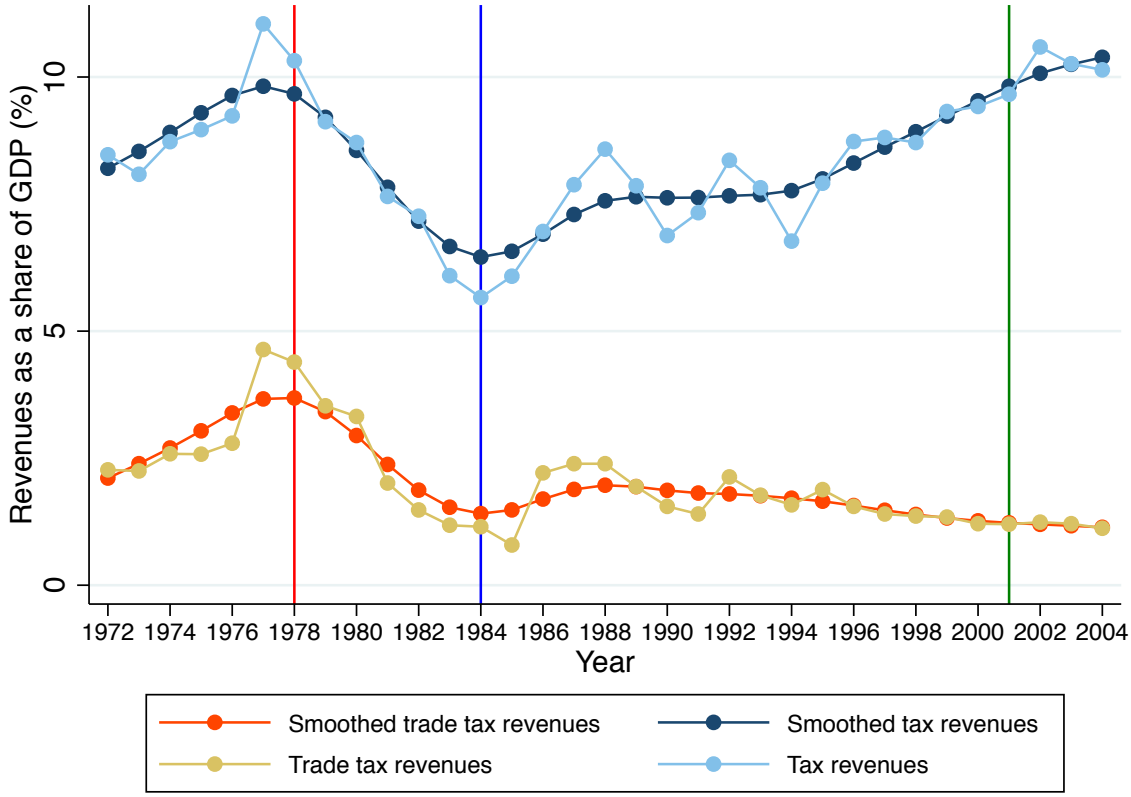


(b) **Trade Tax Revenues**



Notes: Each bar represents a mean taken over the 29 High Income Countries, 28 Middle Income Countries and 30 Low Income Countries for which data on total and trade tax revenues is available in all decades. Each country is given equal weight in the mean. Countries are categorized by their level of economic development in 2006, see the text for a description of the data used and the country income groups.

Figure 2: Definition of trade liberalization episodes and fiscal recovery: example of Guatemala



Notes: The figure illustrates our method for constructing episodes of trade liberalization and the fiscal recovery variable. The vertical red line shows the start of the episode, the blue line its end and the green line the year of recovery. See the text for a description of the dataset used.

Table 1: Evolution of tax ratios, tax structures and GDP per capita since 1830 by level of development

	HICs				MICs				LICs			
	(1) Total tax	(2) Trade tax	(3) GDP	(4) Tariff	(5) Total tax	(6) Trade tax	(7) GDP	(8) Tariff	(9) Total tax	(10) Trade tax	(11) GDP	(12) Tariff
1830-1839	6.6	3.0	1674.5									
1860-1869	9.1	1.4	2161.2									
1890-1899	8.6	1.9	2334.6	11.7								
1920-1929	12.7	2.3	3504.6	6.7	11.5	2.3	1658.5	18.1				
1950-1959	16.9	2.0	5702.8	9.1	9.5	2.2	1734.2	15.9				
1970-1979	22.2	1.6	10754.0	7.1	15.9	4.2	3286.7	15.5	15.6	5.9	970.3	18.6
2000-2006	27.6	0.6	16219.8	1.5	16.1	2.3	4069.0	6.5	14.0	3.1	928.9	9.7

Notes: Each value is a mean over a decade. The table presents descriptive statistics on total and trade tax revenues as a share of GDP, GDP per capita and average tariff rates. Countries are categorized by their level of economic development in 2006, see the text for a description of the data and the country income groups. Each country is given equal weight in the mean. The number of observations in each decade from the top to bottom is (i) HICs: 3, 4, 9, 12, 18, 25; (ii) MICs: 5, 12, 30, 43; (iii) LICs: 30, 40.

Table 2: Evolution of tax ratios, tax structures and GDP per capita since 1970 by level of development, fixed sample of countries

	HICs				MICs				LICs			
	(1) Total tax	(2) Trade tax	(3) GDP	(4) Tariff	(5) Total tax	(6) Trade tax	(7) GDP	(8) Tariff	(9) Total tax	(10) Trade tax	(11) GDP	(12) Tariff
1970-1979	22.5	1.6	11016.0	7.1	16.3	4.4	3196.3	16.0	15.6	5.9	970.3	18.6
1980-1989	25.0	1.1	12741.4	5.0	15.4	3.6	3346.2	14.0	15.1	5.3	946.5	16.7
1990-1999	28.4	0.6	15430.2	3.6	15.1	2.8	3732.3	14.2	13.7	3.9	877.0	19.1
2000-2006	31.0	0.4	18272.8	1.2	15.7	2.3	4115.9	6.7	14.9	3.4	928.3	15.0

Notes: Each value is a mean over a decade. The sample consists of the 29 high-income countries, 28 middle-income countries and 30 low-income countries for which we have data in all decades. Countries are categorized by their level of economic development in 2006, see the text for a description of the country income groups. Each country is given equal weight in the mean.

Table 3: Episodes of decreases in trade tax revenues

		1792-1969				**1970-2006**				Diff. p-values	
	(1) **All**	(2) All	(3) HICs	(4) MICs	(5) LICs	(6) All	(7) HICs	(8) MICs	(9) LICs	(10) Rich/dvp	(11) Pre/post
Size of the episode (GDP points)	3.2	2.3	1.9	2.4	2.3	3.5	2.1	3.1	3.8	0.35	0.01
	(2.3)	(1.3)	(0.9)	(1.4)	(1.1)	(2.5)	(1.3)	(2.2)	(2.7)		
Length of the episode (years)	12	14	17	15	12	11	13	10	12	0.55	0.02
	(6)	(7)	(8)	(7)	(5)	(5)	(3)	(4)	(6)		
Total tax revenues (% GDP)	16.9	14.7	19.7	15.2	11.1	17.7	24.7	18.2	16.9	0.08	0.02
	(7.1)	(6.8)	(8.2)	(6.8)	(4.6)	(7.0)	(10.1)	(6.7)	(7.0)		
Trade tax revenues (% GDP)	5.5	3.8	3.0	3.7	4.2	6.1	2.6	5.4	6.8	0.16	0.00
	(4.0)	(1.6)	(0.9)	(1.8)	(1.4)	(4.5)	(1.2)	(3.6)	(5.0)		
% Pre-empted episodes	6.5	6.5	25.0	4.8	0.0	6.6	100.0	3.6	6.2	0.00	0.79
	(24.8)	(25.0)	(50.0)	(21.8)	(0.0)	(25.0)	(0.0)	(18.9)	(24.6)		
Decrease in tariffs (percentage points)	7.2	9.0	7.4	8.0	14.9	6.4	2.4	9.5	3.2	.	0.28
	(9.9)	(8.9)	(5.7)	(7.6)	(15.5)	(10.3)	(.)	(7.3)	(12.1)		
Number of episodes	140	38	4	25	9	102	3	44	55		
Number of countries	110	30	4	22	8	85	3	39	46		
Number of observations	5206	1862	178	1152	532	3344	927	1224	1193		

Notes: Mean (standard error). The last two columns present two-sided p-values for the difference between developing countries (LICs and MICs) in 1970-2006 and i) HICs in 1970-2006 (column 10) ii) developing countries in 1792-1969 (column 11). The table presents descriptive statistics on our sample of 140 episodes of decrease in trade tax revenues. Total and trade tax revenues are measured at the start of the episode. The number of observations refers to the number of observations in our data set for the period and country income group under consideration. Column 1 presents results for the entire sample of episodes. In columns 2 to 5 (respectively 6 to 9), we present results considering only the period 1792-1969 (respectively 1970-2006). HICs (columns 3 and 7), MICs (columns 4 and 8) and LICs (columns 5 and 9) are defined using the country's income group at the start of the episode. Episodes are obtained on data smoothed using a HP filter with a smoothing parameter of 6.25. See the text for a description of the dataset and the method used to construct episodes.

Table 4: Episodes of decreases in trade tax revenues, changes in trade policy only

		1792-1969				1970-2006				Diff. p-values	
	(1) **All**	(2) All	(3) HICs	(4) MICs	(5) LICs	(6) All	(7) HICs	(8) MICs	(9) LICs	(10) Rich/dvp	(11) Pre/post
Size of the episode (GDP points)	3.1	2.4	1.4	2.6	2.2	3.4	2.4	3.1	3.7	0.56	0.08
	(2.3)	(1.4)	(0.4)	(1.5)	(0.8)	(2.5)	(1.7)	(2.1)	(2.9)		
Length of the episode (years)	12	15	19	15	12	11	15	10	12	0.37	0.01
	(6)	(7)	(13)	(7)	(6)	(6)	(1)	(4)	(7)		
Total tax revenues (% GDP)	16.6	14.2	16.7	15.2	10.1	17.6	20.3	17.8	17.2	0.56	0.03
	(6.9)	(7.0)	(12.8)	(6.8)	(5.3)	(6.6)	(9.2)	(6.1)	(7.3)		
Trade tax revenues (% GDP)	5.3	4.0	2.6	4.1	3.9	5.9	2.4	5.1	6.9	0.28	0.05
	(4.1)	(1.6)	(0.6)	(1.8)	(1.0)	(4.7)	(1.7)	(2.7)	(6.0)		
Decrease in tariffs (percentage points)	9.0	9.8	10.9	9.4	10.3	8.7	2.4	10.1	7.0	.	0.80
	(9.4)	(8.5)	(1.1)	(7.9)	(15.2)	(9.9)	(.)	(7.3)	(13.2)		
Number of episodes	95	27	2	19	6	68	2	34	32		
Number of countries	80	22	2	17	6	61	2	32	28		

Notes: Mean (standard error). The last two columns present two-sided p-values for the difference between developing countries (LICs and MICs) in 1970-2006 and i) HICs in 1970-2006 (column 10) ii) developing countries in 1792-1969 (column 11). The table presents descriptive statistics on the sample of episodes of decrease in trade tax revenues which we can associate with a change in trade policy. Total and trade tax revenues are measured at the start of the episode. Column 1 presents results for the entire sample of episodes. In columns 2 to 5 (respectively 6 to 9), we present results considering only the period 1792-1969 (respectively 1970-2006). HICs (columns 3 and 7), MICs (columns 4 and 8) and LICs (columns 5 and 9) are defined using the country income group at the start of the episode. Episodes are obtained on data smoothed using a HP filter with a smoothing parameter of 6.25. See the text for a description of the dataset and the methods used to construct episodes and determine potential causes of the episodes.

Table 5: The fiscal cost of trade liberalization

		1792-1969				1970-2006				Diff. p-values	
	(1) **All**	(2) All	(3) HICs	(4) MICs	(5) LICs	(6) All	(7) HICs	(8) MICs	(9) LICs	(10) Rich/dvp	(11) Pre/post
% Episodes with no fall in total tax	47.1	55.3	50.0	64.0	33.3	44.1	100.0	47.7	38.2	0.05	0.17
	(50.1)	(50.4)	(57.7)	(49.0)	(50.0)	(49.9)	(0.0)	(50.5)	(49.0)		
% Episodes with no recovery	27.9	7.9	0.0	8.0	11.1	35.3	0.0	34.1	38.2	0.09	0.00
	(45.0)	(27.3)	(0.0)	(27.7)	(33.3)	(48.0)	(0.0)	(47.9)	(49.0)		
Actual recovery time	5	7	6	4	16	4	1	4	4	0.34	0.11
	(8)	(10)	(6)	(5)	(15)	(6)	(0)	(7)	(6)		
Potential recovery time (years)	26.5	46.1	30.8	41.8	64.8	19.2	17.7	16.9	21.0	0.73	0.00
	(20.6)	(29.8)	(6.5)	(21.2)	(46.6)	(7.7)	(5.5)	(8.3)	(6.9)		
% With recovery under 5 years	49.3	56.8	50.0	66.7	33.3	46.5	100.0	48.8	41.8	0.05	0.19
	(50.2)	(50.2)	(57.7)	(48.2)	(50.0)	(50.1)	(0.0)	(50.6)	(49.8)		
% With recovery under 10 years	56.6	64.9	75.0	75.0	33.3	53.3	100.0	52.8	50.9	0.09	0.21
	(49.8)	(48.4)	(50.0)	(44.2)	(50.0)	(50.2)	(0.0)	(50.6)	(50.5)		
% With recovery under 20 years	66.7	84.4	100.0	95.2	42.9	55.1	100.0	60.0	51.5	.	0.01
	(47.4)	(36.9)	(0.0)	(21.8)	(53.5)	(50.3)	(.)	(50.7)	(50.8)		
Number of episodes	140	38	4	25	9	102	3	44	55		
Number of countries	110	30	4	22	8	85	3	39	46		

Notes: Mean (standard error). The table presents descriptive statistics on fiscal recovery for all episodes of decreases in trade tax revenues. The last two columns present two-sided p-values for the difference between developing countries (LICs and MICs) in 1970-2006 and i) HICs in 1970-2006 (column 10) ii) developing countries in 1792-1969 (column 11). The number of observations refers to the number of observations in our data set for the period and country income group under consideration. The last three lines restrict the sample to episodes for which we have data for at least 5,10 or 20 years after the start of the episode. Column 1 presents results for the entire sample of episodes. In columns 2 to 5 (respectively 6 to 9), we present results considering only the period 1792-1969 (respectively 1970-2006). HICs (columns 3 and 7), MICs (columns 4 and 8) and LICs (columns 5 and 9) are defined using the country income group at the start of the episode. Episodes are obtained on data smoothed using a HP filter with a smoothing parameter of 6.25. See the text for a description of the dataset and the method used to construct episodes.

Table 6: Trade liberalization and government expenditures

		1792-1969				1970-2006				Diff. p-values	
	(1) **All**	(2) All	(3) HICs	(4) MICs	(5) LICs	(6) All	(7) HICs	(8) MICs	(9) LICs	(10) Rich/dvp	(11) Pre/post
% Episodes with no fall in expenditures	55.7	68.4	75.0	76.0	44.4	51.0	66.7	47.7	52.7	0.59	0.09
	(49.9)	(47.1)	(50.0)	(43.6)	(52.7)	(50.2)	(57.7)	(50.5)	(50.4)		
% Episodes with no expenditure recovery	23.57	2.63	0.00	4.00	0.00	31.37	0.00	43.18	23.64	0.23	0.00
	(42.60)	(16.22)	(0.00)	(20.00)	(0.00)	(46.63)	(0.00)	(50.11)	(42.88)		
Actual recovery time (years)	4	6	2	4	12	3	3	3	3	0.93	0.08
	(8)	(12)	(3)	(11)	(13)	(5)	(3)	(7)	(4)		
Potential recovery time (years)	26.5	46.1	30.8	41.8	64.8	19.2	17.7	16.9	21.0	0.73	0.00
	(20.6)	(29.8)	(6.5)	(21.2)	(46.6)	(7.7)	(5.5)	(8.3)	(6.9)		
% Episodes with recovery under 5 years	59.4	73.0	75.0	83.3	44.4	54.5	66.7	51.2	56.4	0.65	0.06
	(49.3)	(45.0)	(50.0)	(38.1)	(52.7)	(50.0)	(57.7)	(50.6)	(50.1)		
% Episodes with recovery under 10 years	67.4	78.4	100.0	83.3	55.6	63.0	100.0	52.8	67.9	0.17	0.15
	(47.0)	(41.7)	(0.0)	(38.1)	(52.7)	(48.5)	(0.0)	(50.6)	(47.1)		
% Episodes with recovery under 20 years	79.0	87.5	100.0	95.2	57.1	73.5	100.0	60.0	78.8	.	0.17
	(41.0)	(33.6)	(0.0)	(21.8)	(53.5)	(44.6)	(.)	(50.7)	(41.5)		
Number of episodes	140	38	4	25	9	102	3	44	55		
Number of countries	110	30	4	22	8	85	3	39	46		

Notes: Mean (standard error). The table presents descriptive statistics on expenditure recovery for all episodes of decreases in trade tax revenues. The last two columns present two-sided p-values for the difference between developing countries (LICs and MICs) in 1970-2006 and i) HICs in 1970-2006 (column 10) ii) developing countries in 1792-1969 (column 11). The number of observations refers to the number of observations in our data set for the period and country income group under consideration. The last three lines restrict the sample to episodes for which we have data for at least 5,10 or 20 years after the start of the episode. Column 1 presents results for the entire sample of episodes. In columns 2 to 5 (respectively 6 to 9), we present results considering only the period 1792-1969 (respectively 1970-2006). HICs (columns 3 and 7), MICs (columns 4 and 8) and LICs (columns 5 and 9) are defined using the country income group at the start of the episode. Episodes are obtained on data smoothed using a HP filter with a smoothing parameter of 6.25. See the text for a description of the dataset and the method used to construct episodes.

Table 7: The fiscal cost of trade liberalization, changes in trade policy only

		1792-1969				1970-2006				Diff. p-values	
	(1) **All**	(2) All	(3) HICs	(4) MICs	(5) LICs	(6) All	(7) HICs	(8) MICs	(9) LICs	(10) Rich/dvp	(11) Pre/post
% Episodes with no fall in total tax revenues	49.5	59.3	50.0	68.4	33.3	45.6	100.0	50.0	37.5	0.12	0.17
	(50.3)	(50.1)	(70.7)	(47.8)	(51.6)	(50.2)	(0.0)	(50.8)	(49.2)		
% Episodes with no fiscal recovery	21.1	7.4	0.0	10.5	0.0	26.5	0.0	29.4	25.0	0.40	0.04
	(41.0)	(26.7)	(0.0)	(31.5)	(0.0)	(44.4)	(0.0)	(46.2)	(44.0)		
Actual recovery time (years)	6	8	5	4	19	5	1	4	5	0.38	0.14
	(8)	(11)	(6)	(6)	(16)	(6)	(0)	(6)	(6)		
Potential recovery time (years)	26.7	50.0	33.5	43.2	77.2	17.5	14.5	15.8	19.5	0.60	0.00
	(23.1)	(31.3)	(4.9)	(21.2)	(47.8)	(8.0)	(0.7)	(8.4)	(7.5)		
% Episodes with recovery under 5 years	52.7	61.5	50.0	72.2	33.3	49.3	100.0	51.5	43.8	0.15	0.21
	(50.2)	(49.6)	(70.7)	(46.1)	(51.6)	(50.4)	(0.0)	(50.8)	(50.4)		
% Episodes with recovery under 10 years	62.8	69.2	100.0	77.8	33.3	60.0	100.0	59.3	58.1	0.25	0.50
	(48.6)	(47.1)	(0.0)	(42.8)	(51.6)	(49.4)	(0.0)	(50.1)	(50.2)		
% Episodes with recovery under 20 years	75.5	84.0	100.0	94.1	50.0	66.7	.	70.0	64.3	.	0.21
	(43.4)	(37.4)	(0.0)	(24.3)	(54.8)	(48.2)	(.)	(48.3)	(49.7)		
Number of episodes	95	27	2	19	6	68	2	34	32		
Number of countries	80	22	2	17	6	61	2	32	28		

Notes: Mean (standard error). The table presents descriptive statistics on fiscal recovery for all episodes of decreases in trade tax revenues which we can associate with changes in trade policy.The last two columns present two-sided p-values for the difference between developing countries (LICs and MICs) in 1970-2006 and i) HICs in 1970-2006 (column 10) ii) developing countries in 1792-1969 (column 11). The last three lines restrict the sample to episodes for which we have data for at least 5,10 or 20 years after the start of the episode. In columns 2 to 5 (respectively 6 to 9), we present results considering only the period 1792-1969 (respectively 1970-2006). HICs (columns 3 and 7), MICs (columns 4 and 8) and LICs (columns 5 and 9) are defined using the country income group at the start of the episode. Episodes are obtained on data smoothed using a HP filter with a smoothing parameter of 6.25. See the text for a description of the dataset and the methods used to construct episodes and determine potential causes of the episodes.

Table 8: Average GDP growth rate before and after an episode of trade liberalization

		1792-1969				**1970-2006**			
	(1) **Entire Sample**	(2) All countries	(3) HICs	(4) MICs	(5) LICs	(6) All countries	(7) HICs	(8) MICs	(9) LICs
Growth rate before episode: 1-year average	4.3	3.1	5.1	2.7	3.2	4.8	4.6	4.5	5.1
	(5.1)	(4.1)	(8.0)	(3.5)	(3.2)	(5.5)	(.)	(5.1)	(6.0)
Growth rate after episode: 1-year average	4.8	4.8	6.7	5.0	3.5	4.8	4.1	5.0	4.6
	(4.7)	(4.5)	(2.4)	(5.0)	(3.7)	(4.8)	(1.2)	(4.5)	(5.2)
Change in growth rate (1 year)	0.4	1.8	1.6	2.0	1.1	-0.3	-0.2	0.0	-0.6
	(7.0)	(7.0)	(9.9)	(7.6)	(2.8)	(7.0)	(.)	(6.7)	(7.4)
Growth rate before episode: 3-year average	4.0	3.5	6.4	3.2	2.4	4.3	7.6	3.6	4.8
	(4.3)	(2.9)	(3.3)	(2.5)	(3.0)	(4.8)	(.)	(4.5)	(5.0)
Growth rate after episode: 3-year average	3.9	4.3	3.9	3.8	5.7	3.8	1.9	4.1	3.6
	(3.2)	(2.6)	(2.1)	(1.9)	(3.8)	(3.4)	(4.3)	(3.4)	(3.4)
Change in growth rate (3 years)	-0.1	0.6	-2.6	0.6	2.6	-0.4	-10.7	0.1	-0.6
	(4.6)	(3.1)	(5.1)	(2.1)	(3.3)	(5.1)	(.)	(4.6)	(5.4)
Growth rate before episode: 5-year average	4.1	3.7	5.7	3.4	3.7	4.2	7.6	3.7	4.7
	(4.0)	(2.6)	(2.4)	(2.4)	(2.9)	(4.5)	(.)	(4.1)	(4.9)
Growth rate after episode: 5-year average	3.5	3.7	4.2	3.2	5.0	3.4	1.7	3.7	3.3
	(3.1)	(2.6)	(1.5)	(2.8)	(2.1)	(3.2)	(2.9)	(3.2)	(3.3)
Change in growth rate (5 years)	-0.4	0.2	-1.5	0.1	1.4	-0.6	-9.1	-0.2	-0.7
	(4.4)	(3.1)	(3.7)	(3.2)	(1.9)	(4.9)	(.)	(4.1)	(5.5)
Growth rate before episode: 10-year average	4.2	3.5	5.5	3.2	3.3	4.5	7.6	3.9	4.9
	(3.7)	(2.0)	(2.3)	(1.9)	(1.6)	(4.3)	(.)	(3.8)	(4.8)
Growth rate after episode: 10-year average	3.4	3.4	3.9	3.3	3.6	3.5	1.7	3.9	3.2
	(2.4)	(2.0)	(0.7)	(1.9)	(2.5)	(2.6)	(3.1)	(2.0)	(2.9)
Change in growth rate (10 years)	-0.5	0.2	-1.7	0.5	0.1	-0.8	-9.4	-0.0	-1.3
	(4.0)	(1.6)	(2.1)	(1.1)	(2.3)	(4.7)	(.)	(3.5)	(5.3)
Number of episodes	140	38	4	25	9	102	3	44	55
Number of countries	110	30	4	22	8	85	3	39	46

Notes: Mean (standard error). The table presents descriptive statistics on average growth rate for all episodes of decreases in trade tax revenues. The number of observations refers to the number of observations in our data set for the period and country income group under consideration. Column 1 presents results for the entire sample of episodes. In columns 2 to 5 (respectively 6 to 9), we present results considering only the period 1792-1969 (respectively 1970-2006). HICs (columns 3 and 7), MICs (columns 4 and 8) and LICs (columns 5 and 9) are defined using the country income group at the start of the episode. See the text for a description of the dataset.

Table 9: Characteristics of episodes by existence of fiscal cost and revenue recovery

Episodes in developing countries since 1970			
	(1)	(2)	(3)
	Fiscal cost	No fiscal cost	Diff. p-value
GDP per capita	2373.62 (258.31)	2494.96 (281.97)	0.75
Total tax revenues (% GDP)	18.41 (0.99)	16.18 (0.89)	0.11
Trade tax revenues (% GDP)	6.27 (0.59)	6.13 (0.71)	0.88
Democracy index	-2.36 (0.88)	-1.36 (1.06)	0.47
Number of episodes	57	42	
Episodes in developing countries since 1970 with a fiscal cost and 10 years of data			
	(1)	(2)	(3)
	No recovery after 10 years	Recovery after 10 years	Diff. p-value
GDP per capita	2191.05 (259.09)	1612.44 (419.94)	0.34
Total tax revenues (% GDP)	18.51 (1.22)	17.58 (2.09)	0.74
Trade tax revenues (% GDP)	6.82 (0.74)	5.40 (0.81)	0.40
Democracy index	-3.60 (0.93)	-0.78 (2.15)	0.22
Number of episodes	43	9	

Notes: Each value in the first two columns is a mean over a sub-sample of episodes in our data with standard errors in parentheses, the third column presents the two-sided p-value of the difference between the values in the first and second column. The sample in the first panel is all episodes which occur in developing countries since 1970, the first column includes all episodes for which there is a fiscal cost and the second all episodes for which there is no fiscal cost. The sample in the second panel is all episodes which occur in developing countries since 1970, for which there is a fiscal cost and at least 10 years in the data after the start of the episode. The first column includes all such episodes for which there is no fiscal recovery after 10 years, the second all such episodes for which there is recovery after 10 years. See the text for a description of the variables used.