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Convergence in Corporate Statutory Tax Rates in the Asian and Pacific Economies

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Abstract:

Countries in the Asia and Pacific region have shown many macroeconomic similarities during a period of economic integration. This paper argues that there may be one more macroeconomic feature to add to the list: strong statutory tax convergence. Using data on the statutory corporate tax rate in 15 countries from 1980 to 2014, we identify (i) a significant dynamic tax convergence pattern, and (ii) three tax convergence clubs. The latter consist of the small tax haven economies of Hong Kong and Singapore, the East Asian countries (plus one), and the South and Southeast Asian and Oceania countries. These economies, within groups, have been reducing the tax gaps with their neighbours over time.

JEL classification: C22, E62

Key words: convergence clubs, tax policy, Asia and Pacific region

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1. Introduction

The growing international exchange of products and factors has contributed to the strong integration in the Asia and Pacific region, which includes countries such as Australia, China, Fiji, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, New Zealand, Pakistan, the Philippines, Singapore, Taiwan and Thailand. In particular, in 1967, Indonesia, Malaysia, the Philippines, Singapore and Thailand initiated the creation of the Association of Southeast Asian Nations (ASEAN), aiming to achieve a single common market by 2015 through gradual economic integration. Regional integration would come with some kind of fiscal policy coordination, and in particular, tax system coordination. Against this backdrop, this paper is the first to raise the question of whether tax policies are converging in the Asia-Pacific region.

With increasing capital mobility and foreign direct investment (FDI) across country borders, as well as the recognition that FDI is an important force for economic growth, governments in Asia have extensively engaged in strategic tax policies designed to attract footloose firms from abroad. Hence, countries may compete to attract FDI. In a recent contribution, Chen et al. (2014) provide a theoretical model based on economies of agglomeration that explains tax competition among regions; see also Stewart and Webb (2006), Devereux (2012) and Liu (2014). Hence, convergence of tax rates may well occur as a result of competition to attract foreign corporations.

Since the start of the 2008 Great Recession, it has been acknowledged that capital inflows may be an important source of credit creation, which may in turn boost economic growth, with this having been particularly true before 2008 (Carvalho, 2014). The rationale behind this is that foreign capital may be used to finance internal spending, in particular in booming sectors, such as the housing market in some peripheral European countries. Given that foreign capital has clearly been a cheap source of funding for local economies, one way that governments can make it easier for foreign companies to establish themselves is to soften their tax burdens. FDI may have an important impact on the host economy by means of job creation and technology spillovers, which may boost aggregate demand. In a recent paper, Cuestas and Regis (2013) analysed the effect of capital inflows on real exchange rates, and vice versa, in a number of East Asian countries, and found that capital mobility is significant, and that movements in competitiveness have an impact on capital inflows.

Since taxes can affect final prices, tax policies may affect the competitiveness of a country in terms of attracting foreign capital.

Tax convergence may well be explained by globalisation and economic integration. Since 1980, many countries have relaxed their restrictions on capital mobility and have tried to integrate themselves into the world economy. Bretschger and Hettich (2002) found a negative and significant impact of globalisation on corporate taxes for 14 OECD countries. This finding is in line with the tax law convergence claimed by Avi-Yonah (2010). In the past 30 years, consumption value added tax (VAT) has been widely introduced by many countries, gradually replacing direct taxes on corporate benefits and labour income. This may have enhanced the corporate tax rate harmonisation.

There is a large literature on tax competition, economic integration and tax regime shifts, all of which lead to increasing pressure on tax policy harmonisation and thus provides an explanation for the existence of tax convergence (see Velayos et al., 2008). However, studies on tax convergence itself are surprisingly rare. A few papers analyse tax convergence using a macro tax burden or fiscal pressure indicator such as tax revenue. Additionally, most focus on European Union (EU) countries, where the process of economic integration has accelerated the discussion on fiscal harmonisation. For instance, Delgado and Presno (2010) found little evidence of tax convergence (1965–2005) in the EU-15, using both the revenue to gross domestic product (GDP) ratio and the tax mix ratios as benchmarks. Becker and Elsayyad's (2009) study, through the introduction of a bilateral similarity index to measure the similarity of tax systems conditional on country characteristics, identified a slight convergence in OECD tax systems. The main findings from the literature indicate that high tax rate countries have cut their taxes the most in previous years, which has led tax rates to converge slightly over time. Recently, Apergis and Cooray (2014) showed that there was no full convergence of total tax revenues and their composition across the Asia-Pacific countries in the period 1990–2012; however, club convergence was identified, with three or four clubs identified, depending on the type of revenue studied.

Given the clear path taken by the Asian countries towards a more integrated region, fiscal harmonisation is on their agenda. Moreover, according to Bettendorf et al.

(2010), for fiscal harmonisation, governments need to contemplate not only tax base consolidation, but also rate harmonisation. In this study, the evidence concerning corporation tax rate convergence is directly tested using a sample of 15 countries from the Asia-Pacific region. Cluster analysis is performed through the application of the new methodology of panel convergence testing proposed by Phillip and Sul (2007, 2009), and beta convergence and sigma convergence are also taken into consideration. The results support convergence in tax rates across the Asian and Pacific countries. Interestingly, this convergence result may also be related to the race to the bottom empirical literature, which has explored the declining trend of corporate income tax rates around the world (including the Asia-Pacific region) in studies such as those by Slemond (2004), Stewart and Webb (2006) and Devereux et al. (2008). That is, while the literature has identified a negative trend in corporate tax, club convergence would imply the distribution is concentrated around a number of clusters.

The rest of this paper is organised as follows. Section 2 describes the tax data. Section 3 reviews the most commonly used concepts of beta and sigma convergence and presents the regional tax convergence result. This is followed by the identification of convergence clubs within the region, in Section 4. The last section concludes.

2. The data: Statutory tax rates

In order to assess tax convergence, we need a measure that can be compared across countries and over time. However, there is no clear-cut way to summarise a country's complex corporate tax system. Some countries adopt multiple-rate systems, with specific rates by sectors, while others may have graduated corporate tax rate structures. Three choices are generally considered in the literature: marginal effective tax rates, average tax rates and statutory tax rates. Fullerton (1999) was the first to develop the approach of assessing effective tax rates, which is a useful way to assess the micro-level decisions made by companies. Nonetheless, such estimates are project-specific and sensitive to assumptions about economic fundamentals and legislation. Moreover, in the Asian and Pacific countries, the data needed to calculate this estimate are difficult to collect, making it unavailable for country-level comparisons. By far the most commonly adopted measure in cross-country studies is the average corporate tax rate, defined as tax revenues over GDP. Criticisms of this

measure mainly stem from the fact that an increase in the average corporate tax rate may be due to a recession in the business cycle or an increase in the presence of organisations instead of an increase in the tax rate. The alternative choice is the statutory tax rate, though arguably it may fail to comprehensively analyse the corporate tax base, including the inventory allowance system, inflation adjustment and depreciation schedules, holidays and availability of credits to investment, as summarised in Slemrod (2004). However, the legal tax rate is a highly transparent and clear measure of fiscal policy and tax schemes. Thus, we use it in this paper as the measure of corporate income taxes.

In this study, unlike in previous studies, the variable of interest is the statutory tax rate rather than the tax revenue, the aim being to use a proxy that is simple to interpret and independent of business cycle effects. The main data source is the World Tax Database for the period 1980–2003, expanded when necessary with KPMG corporate tax rates (1993–1996) and KPMG's Corporate and Indirect Tax Rate Survey (1999–2014). The OECD tax statistics database (1981–2014) is also used for the four OECD countries in our sample. The World Tax Database is one of the first attempts to gather comparable figures for statutory tax rates for a large number of countries. Two of the sources of the original database are KPMG and OECD. Therefore, we select the available data for the Asia and Pacific region in 1980–2003 and update the data up to 2014 from two of the original sources. Summary statistics by country in four different years (1980, 1991, 2002 and 2014) can be found in Table 1.

3. Tax convergence

Alternative concepts of convergence have been developed, such as absolute beta convergence, sigma convergence, conditional beta convergence, stochastic convergence and club convergence, among others. Of these, absolute beta and sigma convergence are more directly related to the original ideas of the convergence literature. Also, it is relatively simple to produce graphical representations of them. Beta convergence has to do with poor countries growing faster than richer ones, depending on their past or initial values (Sala-i-Martin, 1996). In our framework, it is given by:

$$\Delta \text{tax}_{2014-1980} = \alpha + \beta \, \text{tax}_{1980} + \varepsilon \, , \tag{1}$$

where ε is the error term. A significant and negative β is indicative of beta convergence. Convergence in GDP usually is defined with variables in logs; however, our approach is to use the original variable since tax rates are measured in percentages, making the economic interpretation of the results straightforward. In Figure 1, changes in the tax rates are compared with the initial tax rate. The negative slope of the regression line shows the absolute beta convergence of corporate tax rates:

$$\begin{matrix} \Delta \hat{\text{tax}}_{2014-1980} = 7.784 - & 0.706 \, \text{tax}_{1980} \\ (5.845) & (\ 0.157) \end{matrix} \, . \tag{2}$$

Standard errors are given in brackets. The beta convergence coefficient is negative and significant at 1%. However, as there are only 15 observations the results should be interpreted with caution. In this case, tax convergence has been achieved through cuts in statutory tax rates: countries with high tax rates converging to a lower tax rate. The countries with the highest tax rates in 1980 have cut their taxes the most (e.g., China and India), while countries with low tax rates in 1980 (e.g., Hong Kong) have barely changed their tax rates. The speed of convergence is around 3.4% per year,[1] while the average annual (negative) change is 1.5%. This suggests that tax rates appear more alike at the end of the period, with a rapid rate of convergence.

Friedman (1992) and Quah (1993) argue that sigma convergence is of more interest since it directly examines whether countries are becoming increasingly homogeneous. Beta convergence is a necessary, but not sufficient, condition for sigma convergence, as can be seen in Furceri (2005) and Young et al. (2008). Sigma convergence indicates that whether the dispersion of the distribution is declining over time. Figure 2 shows the evolution of the standard deviation of tax rates. The clear negative trend indicates sigma convergence during the full period, with a small-scale upturn in the last 5–8 years. The standard deviation shrinks by almost half, which is quite an interesting evolution in the dynamic behaviour of tax rates. This result also suggests that countries are more alike at the end of the period, with similar statutory tax rates. In 2007, the average tax rate was 28.3% with a typical deviation in a country of ± 5%.

[1] For completeness, if the tax rates were transformed into logs, the coefficient would still be statistically significant and the speed of convergence would be 1.8%.

Both figures have decreased from the 1980 figures of 41% (mean) and 10.8% (standard deviation). The mean tax rate continues to decrease until 2014, ending up at 24.3%, while the standard deviation increases to 5.5%.

4. Cluster analysis and tax convergence

The beta and sigma convergence analysis is complemented with a study of convergence clubs, which makes better use of the heterogeneity in behaviour across countries. According to Phillips and Sul (2007), dynamics need to be modelled under the assumption of heterogeneity. Their theoretical approach justifies the use of statistical methods that provide the ability to identify clusters or clubs of convergence, and are not based upon unit root and co-integration analysis.

4.1. Logt convergence: The logt test

In cases where convergence has been rejected, some have followed a clustering strategy to identify convergence clubs that may explain the overall non-convergence, exploring the heterogeneity in the inter-temporal behaviour within the sample. That is, the above definitions of convergence may be inadequate when the economic fundamentals are different across the countries analysed. In the case of tax rates, the fundamentals behind the long-run differences across clusters could be related to the structural characteristics of the countries' tax systems.

Phillips and Sul (2007, 2009) argue that a panel can be decomposed into two main components:

$$Y_{it} = \{y_{1t}, y_{2t}, \dots, y_{Nt}\} = \mu_t \delta_{it}, \tag{3}$$

namely, the common component μ_t and the idiosyncratic component δ_{it}. The fundamental idea behind the procedure is to test whether δ_{it} converges to a common value, δ. In order to test this hypothesis, these authors propose the analysis of the following semi-parametric equation:

$$\delta_{it} = \delta_i + \frac{\sigma_i \xi_{it}}{[log(t)]t^{\alpha}}\ , \tag{4}$$

where $\xi_{it} \sim iid(0,1)$ across i but is weakly dependent over t and $\sigma_i > 0$. According to the formulation in Equation (4), the key parameters for convergence are α and δ_i. Convergence of δ_{it} to δ happens when $\alpha \geq 0$, so $\delta_{it} \to \delta_i$ when $t \to \infty$, and at the same time $\delta_i \to \delta$ for all i. The joint hypothesis $H_0: \delta_i = \delta \; and \; \alpha \geq 0$ can be empirically tested by means of the following auxiliary regression:

$$\log(\sigma_{h\,1}^2/\sigma_{h\,t}^2) - 2\log[\log(t)] = c + b\log(t) + u_t, \tag{5}$$

where

$$\sigma_{h\,t}^2 = \frac{1}{N}\sum_{i=1}^{N}(h_{it} - 1)^2 \tag{6}$$

is the squared average transition differential, and

$$h_{it} = \frac{\delta_{it}}{\frac{1}{N}\sum_{i=1}^{N}\delta_{it}} = \frac{Y_{it}}{\frac{1}{N}\sum_{i=1}^{N}Y_{it}} \tag{7}$$

is the relative transition path. Under the null hypothesis of convergence, $\sigma_{h\,t}^2 \to 0$. From Equation (5) one can estimate α as $\hat{\alpha} = \hat{b}/2$. For this estimate of α to be valid, it is required that $\delta_i = \delta$ since $\hat{b}$ is estimated to be constant across countries.[2]

Therefore, the null hypothesis of convergence ($H_0: \delta_i = \delta \; and \; \alpha \geq 0$) is a one-sided test based on the t-statistic of $\hat{b}$, which focuses on the evolution of the transition paths over time compared to the common growth component. This is a time series regression where a transformation of the cross-sectional variance of h_{it} is regressed against $\log(t)$, whose coefficient and t-statistic, which we refer to later as the logt-statistic, are the values of interest. If, for all economies in a convergence club, $h_{it} \to 1$ as time evolves, then the cross-sectional variance of h_{it} converges to zero and there is convergence. Note that, since the statistic is based on the variance of the logarithm of the variable of interest, this test is more related to sigma than beta convergence.

[2] In addition, Phillips and Sul (2009) claim that depending on the estimated values of $\hat{b}$, one can assess whether the processes present absolute convergence, i.e., level convergence, or conditional convergence, i.e., convergence in growth rates. Hence, if $\hat{b} \geq 2$ the processes converge in levels, whereas if $0 \leq \hat{b} < 2$ the processes present conditional convergence. That is, stronger evidence in favour of convergence is required if we are to conclude that there is level convergence. However, note that because this is the analysis of a variable that can only assume values between 0 and 100, long-run growth may not be realistic. Within this framework, convergence in growth rates would eventually lead to either overall or cluster convergence in levels.

The alternative hypothesis includes two general cases: divergence and club convergence. If the null hypothesis of convergence is rejected, it may be because there is no convergence ($\alpha < 0$). Alternatively, it may be that $\alpha \geq 0$ but not all δ_i converge to a single δ for all countries. Here, the variance of h_{it} converges to a constant rather than zero, which is consistent with having two or more convergence clubs. In other words, there are multiple equilibrium values, and different groups of countries converge to different values. Identifying the composition of these groups would help to test whether there is within-group convergence.

Phillips and Sul (2007) developed a four-step clustering algorithm whereby convergence clubs are identified by endogenised groupings. The cluster procedure is based on the logt test from Equation (5), performed iteratively over country subsamples. In Step 1, countries are sorted in descending order according to the last period of analysis of the variable of interest, namely the tax rate. In Step 2, a core of k countries of a convergence club is formed, by taking the first two countries in Step 1, computing the logt-statistic and, if the statistic is larger than -1.65, adding the remaining countries to the core one by one in descending order and computing the new logt-statistic until it is less than-1.65. In Step 3, the remaining countries are added one at a time and the logt-statistic is computed to check whether they can be added to the convergence club. In Step 4, the logt-statistic is computed for the remaining countries to check whether they form a convergence club (i.e., logt-statistic > -1.65). Otherwise, Steps 1–3 are repeated to check whether there is more than one club. The critical value at 5% is -1.65 because the statistic is distributed as N(0,1) and the alternative is one-sided. See Phillips and Sul (2007) for further details.

4.2. Clusters in the Asia and Pacific region

The overall picture in Section 3 shows strong indications of convergence in tax rates. Although sigma convergence has not been rejected, this is not inconsistent with the existence of convergence clubs and, if they do exist, it would be of interest to identify them. The general trend is downwards in terms of the dispersion of statutory tax rates; however, this can happen due to different reasons, and clustering can be used to explore heterogeneity patterns across convergence clubs that occur at the same time as

homogeneity is increasing within the clubs. The cluster composition can help us to understand some of this heterogeneity.

The results of our analysis are displayed in Table 2, in which the variable of interest (Y_{it}) is defined as the statutory tax rate. The last column shows a logt-statistic of -4.085, according to which the null of overall convergence in the full sample of 15 countries is rejected. This result contrasts with our findings in Section 3 in favour of convergence. However, the absence of overall logt convergence may still be consistent with beta and sigma convergence if there is evidence of club convergence. Sigma convergence, for example, does not distinguish between overall convergence (long-run variance of 0, i.e., $\sigma_{Y\,t}^2 \to 0$) and club convergence (converging from above to a constant, i.e., $\sigma_{Y\,t}^2 \to \sigma_Y^2 > 0$). This implies that the clustering algorithm should be applied recursively until all clubs have been identified.

Interestingly, the application of the Phillips and Sul (2007) cluster algorithm reveals that there are three clusters: convergence Club A, with nine countries; Club B with four countries and Club C, a small cluster of two countries (see Column 3 for their composition). The groups are organised according to their average tax rate in the last three years (Column 2). Column 5 contains the logt test results, which show that we cannot reject the null of convergence in any of these three cases. This means that there is evidence of tax convergence within each cluster.

Column 4 shows the t-statistic of sigma convergence, for which the null of no log time trend in the variance of tax rates (in logs) implies no convergence. This test is based on the similarity of the concepts of logt convergence and sigma convergence. According to Equation (5), logt convergence examines whether there is a time trend in the time variance of the transition parameter h_{it}. This is the variance of the variable of interest Y_{it} normalised by its cross-sectional mean in each period. Other than the normalisation to the cross-sectional sample average, logt convergence appears to be similar to the sigma convergence test, with a particular form of time trend.

Since all t-statistics reject the null of no convergence at 1%, there is evidence of sigma convergence within the clusters. In Figure 3, within-cluster sigma convergence confirms convergence within these clubs is even stronger, if anything, than for the full sample. The general convergence trend of the full sample is quite similar to that of the

largest convergence club, Club A with nine countries, but within Club A, convergence seems to have accelerated since the early 1990s. Club convergence among the Club B countries has been even more rapid than in Club A, while Club C's convergence has been the most rapid.

The same test of sigma convergence for the overall sample provides a t-statistic of -5.93 (not reported in Table 2), which is consistent with the sigma convergence in Figure 2, although it seems to contradict the rejection of overall logt convergence. This may be explained by the term $2\log[log(t)]$ on the left-hand side of Equation (5), which has not been included in this sigma convergence test. This difference between the two tests may be very important in practice. According to Phillips and Sul (2007), this is a penalty function that improves the performance of the test. It helps the test to distinguish between overall convergence (not rejection of the null) and club convergence (rejection). Therefore, the sigma convergence test does not distinguish between sigma and cluster convergence, while the logt test does.

Figures 4 and 5 present the evolution of the relative transition functions h_{it}. The analysis of h_{it} provides an opportunity to explore the heterogeneity of the sample in more detail. Convergence would imply increasing homogeneity of h_{it} and the curves should concentrate around 1 (which is, by construction, the average value of h_{it}). In these graphs the convergence paths are clearly shown and they confirm the results in Table 2. Figure 4 depicts the transition curves aggregated at the cluster level, and shows no sign of convergence. Clusters A and B are more similar to each other than to Cluster C. However, the trend shows that, overall, the clusters are becoming more distinctive, if anything.

The three graphs in Figure 5 show the dynamics within the clusters. The convergence is very rapid within Cluster C, and more rapid than in the other two clubs. One interesting point is that cluster convergence for the other two clubs seems to have been faster before 2008 and the Great Recession, than afterwards. Clusters A and B show an increase in dispersion after 2008, which may have been motivated by the financial crisis. The general negative trend of the statutory rate continues, driven by countries with low rates, in each cluster. In Cluster A, Thailand and Fiji reduced their rates from 28% and 30% in 2011 to 20% by 2013, while Taiwan had made an 8% tax cut even earlier, in 2010 (to 17%). Taiwan and Thailand, with the lowest tax rates for

most of the period under study in each cluster, could be considered the front runners of tax cuts.

To formally test convergence excluding the effect of the financial crisis, we ran the Phillips and Sul (2007) algorithm for a subsample up until 2007, leaving the years of the crisis out of the analysis. The results, which are not reported here for the sake of brevity, point to the existence of only two clusters, with Hong Kong and Singapore in one cluster and the rest of the countries in the second cluster. The Phillips and Sul (2009) test of overall convergence is rejected, meaning that the two clusters cannot be merged. It is interesting that Clusters A and B from the full sample period have merged.

Finally, to check the robustness of our analysis, we applied Robinson's (1995) multivariate test for fractional integration, based on a semi-parametric approach, which allowed us to both estimate the differencing parameters and test for the hypothesis of their equality among countries. This analysis is based on fractional integration methods. A fractionally integrated process is a process whose order of integration is any non-integer number between 0 and 1, hence breaking the dichotomy of traditional tests for the order of integration of variables I(d), which classify variables as I(1) or I(0). We considered this complementary analysis as a robustness check for the following reasons: it allows us to analyse how (dis)similar the persistence of shocks to the target variable is. It also allows us to test, in a more flexible way, the order of integration of the variable, as the order of integration is not an integer. Finally, we can test the null of equal orders of integration, which in essence is a test for similar responses to shocks. Hence, the Robinson (1995) approach, since it is applied within a panel framework, can provide us with valuable information about the similarity of the dynamics and mean reversion among countries' tax rates.
We analyse the autoregressive, fractionally integrated, moving average ARFIMA(p, d, 0) of the form:

$$\Phi_p(L)(1-L)^d y_t = \varepsilon_t, \quad t = 1,...T, \tag{8}$$

where $\Phi_p(L)$ is a polynomial of order p, with all zeros of $\Phi_p(L)$ outside the unit circle, and ε_t a white noise process. Table 3 displays the results of the estimations.

The first point to notice is that the estimated parameters are well above 0.5, which is indicative of high persistence, meaning that the steady state has not yet been achieved. Second, the test for equality of the differencing parameter confirms the results obtained in Table 2; i.e., the speed of adjustment is similar within clusters.

With the clusters identified and club convergence confirmed, it is possible to test for convergence among the clusters. This is important, since Phillips and Sul (2009) recognised that their procedure/algorithm (Phillips and Sul, 2007) may overestimate the number of clusters. Hence, they proposed a test for overall convergence, which allows us to test whether or not the clusters converge among themselves. This is the same test as was performed within the clusters separately, but now two clusters are grouped at the same time. If the logt test supports the hypothesis of overall convergence, this suggests that the countries in the two clusters are also converging over time. Therefore, this test is usually considered to be a convergence club merging test, from which a larger cluster may emerge in the long run.

In Column 6 of Table 2, two logt-statistics of convergence, of Clusters A with B and B with C, are reported. The overall logt test (Column 7) and the cluster transition curves (Figure 4) support the fact that the clusters do not converge among themselves; however, the results imply that Clusters A and B may be converging,[3] while Cluster C is clearly not. This suggests that in the long run, tax rates may become homogeneous in the region, with the possible exception of the tax haven economies, which have a distinctive dynamic from the rest.

Finally, the composition of the clubs is also interesting, especially when compared with a large international sample. Table 4 presents the statutory tax rate of 111 countries for which data is available in 2013, including the 15 from our sample. The extended sample increases the international comparability of our results. Overall, our sample of 15 countries is well scattered, with a low presence at the lower end, if any.

The average statutory tax rate during the last three years for Cluster C is 16.8%, quite low compared to the rest of our sample (6.2 percentage points, below Club B's average) and at the lower end of international standards (see Table 4). Comparative

[3] At this point, note that the convergence of Clusters A and B would be consistent with the analysis of the period 1980–2007 described earlier.

studies of tax incentives in Hong Kong and Singapore, the two members of Club C, are very popular (see Lam, 2000, and Phua Lye Huat and Halkyard, 2012). Their tax structures aim to attract foreign investment. Although they have followed different approaches to stimulate business (Hong Kong followed simple and stable rules, while Singapore followed discretionary intervention) they have been very successful at attracting foreign capital, competing with each other for this.

Hong Kong and Singapore are special cases since they are tax haven countries. Although there is more than one definition of tax haven, a common reference is OECD (1998). Hines and Rice (1994) identified Hong Kong and Singapore as two[4] of the 'big seven' tax havens in the early 1990s. More recently (2013), the Tax Justice Network (www.taxjustice.net/) has ranked Hong Kong and Singapore in the tax haven top five, according to the 2013 Financial Secrecy Index. The taxation policies in tax havens behave differently than in non-tax havens, so this must be recognised in our analysis. Low (or nil) corporate tax is a condition, but not the essential element, of a tax haven. Hong Kong and Singapore provide confidential financial and legal services to non-residents and corporations, preventing effective information exchange with other countries.

The average tax rate of Cluster B is 23%, which is close to the international average. According to Table 4, the global average is around 23.2%, while the OECD (33 countries) and EU (27 countries) averages are 23.4% and 21.3%, respectively. China, South Korea and Taiwan are the countries of East Asia, a region with important economic and cultural ties. The East Asian countries[5], together with Malaysia[6], make up convergence Club B, which suggests that the tax convergence of East Asia within the Asia and Pacific region has been important, but that tax convergence within the East Asian countries has been even stronger and in fact happened earlier.

[4] Although 'big' refers to population (i.e., greater than one million inhabitants), Hines and Rice (1994) estimate the Big-7 account for 40% of assets, equity and net income in tax havens of US corporations. Hines and Rice (1994) do no list any other country of our sample as a tax haven.

[5] Japan is also commonly designated to the East Asian region. However, in our analysis, Japan does not seem to behave similarly to the other East Asian countries. This may be because the corporate tax system in Japan is more complex than in the rest of the region.

[6] It should be noted that China has a strong influence in Malaysia, with 20–25% of the population having Chinese ancestors, especially from the Canton region. China and Malaysia have had strong commercial links for a long time. However, it may be argued that the cultural and commercial ties that Malaysia has with countries such as Indonesia or Singapore are stronger.

It is more difficult to find the connection among the countries in Group A, the largest cluster, since it is a mix of South and Southeast Asian countries and countries from Oceania. The 2012–2014 average tax rate of 27.6% is the highest among the three clusters, and comparable to moderate-to-high corporate tax countries, such as Italy (27.5%), Norway (28%) and South Africa (28%). However, the convergence process here is almost as strong as in Clubs B and C. Figure 3 shows that the standard deviations of the three groups in 2008 are quite similar, while there is a slight increase at the end of the period for Clusters A and B.

These results are similar to some of the findings of Wang (2007), who studied cluster convergence of tax burden and GDP growth. His sample includes our four East Asian countries (China, Japan, South Korea and Taiwan) and another 20 OECD countries. China, South Korea and Taiwan form a convergence cluster, while Japan belongs to a different cluster, which also includes New Zealand and Australia (with other six OECD countries). These results are consistent with some of our findings: the first cluster is very similar to our Cluster B while Japan, Australia and New Zealand belong to Cluster A. However, comparability is limited by the difference in the clustering algorithm and the exclusion of other Asian countries.

On the other hand, Apergis and Cooray (2014) find different results using the same methodology as we do for a sample of 11+ Asian and Pacific countries. Tax revenue is disaggregated into five main sub-categories, making use of the revenue-to-GDP ratio. There is lack of overall convergence in total revenues, including two divergent countries: China and Japan. When looking at personal income, profit and capital gains taxes, they found three clusters but the overlap with our clusters is limited. However, the main limitation of Apergis and Cooray (2014) is the short time span. Based on the 1990–2012 period, their logt-statistics are based on only 23 time periods.

5. Conclusions

With the increasing degree of economic integration in the Asia and Pacific region, the convergence of the fiscal systems across these countries warrants a thorough analysis. This paper examines the statutory corporate tax rate in the 15 Asia-Pacific countries within the period 1980–2014 and shows that convergence is prevalent in the region. In

contrast to most previous convergence test results for taxes, the statutory rates are de facto harmonised within the Asia and Pacific region, with its different degrees of national fiscal autonomy, economic structures and political preferences.

Two strands of the literature may help to explain the existence of tax convergence. First, the tax competition literature has proposed that negative trends may be explained by the strategic behaviour of governments when competing for the location of corporations. In a recent study, Chen et al. (2014), using an IV-GMM strategy to estimate the national-level tax reaction function, found evidence in favour of tax competition in 14 Asia-Pacific countries, of the sort that would explain the negative slopes in Figures 1 and 2. These results, along with ours, suggest that tax competition among regions indeed produces a Nash equilibrium.

Second, tax convergence may be part of globalisation and economic integration in the Asia-Pacific region. In this case, tax convergence could be explained as part of a cooperative game in which governments have recognised the importance of transnational enterprises in an integrated world. This would promote more homogeneous tax setting, with countries with relatively high corporate taxes cutting their rates. Avi-Yonah (2010) identified two general trends that partially explain corporate tax convergence: the generalisation of VAT replacing corporate taxes, and the cross-country integration of corporate taxes (e.g., the elimination of double taxation), which may have created incentives to homogenise corporate tax regimes. Jogarajan (2012) presented a discussion of the network of bilateral tax treaties that has resulted from cooperation in the region.

The sigma and beta convergence might well be driven by increasing capital mobility as measured by flows of financial capital, flows of FDI and the relaxation of restrictions on capital and financial flows in the integration process. More importantly, using the panel convergence proposed by Phillips and Sul (2007), we find that the cross-country variance in the statutory corporate tax rates not only declines across time, but converges to three convergence clubs. This is consistent with the existence of more than one Nash equilibrium, as in the theoretical work of Taugourdeau and Ziad (2011). In other words, the speed of tax rate adjustment is shown to be similar within clusters, but different across clusters, in the transitional dynamics before the steady state is reached. This is also confirmed using the multivariate test for fractional

integration, which captures the tendency to converge. In sum, we contribute to the convergence literature by modelling both transitional dynamics and the long-run behaviour in a consistent framework.

The policy implications from this study are twofold. On one hand, we argue that taxation, among other factors such as labour markets and supply chains, is not, and should not be, an impediment to greater integration and economic growth across the Asia and Pacific countries, at least within the convergence clubs. This study allows policymakers to implement measures to promote greater integration between countries with divergent tax systems to prevent a race to the bottom due to tax harmonisation. On the other hand, the downward tax convergence trend led by countries with relatively high corporate taxes cutting their rates to attract footloose capital raises concerns regarding tax policy autonomy as well as welfare concerns when the tax burdens are shifted from mobile to less mobile factors.

A caveat in this paper is that, although affirmative patterns of the statutory corporate taxation are confirmed, it does not suffice to identify the determinates, whether these are the domestic factors or regional competitive pressures, that shape the convergence pattern within and between the clusters. However, the latter question has been addressed in the literature, primarily in cross-country studies of tax reaction functions that predict similar interdependent behaviour in statutory corporate tax rate setting among countries. Future empirical attempts could tackle the interaction between tax convergence and convergence in other economic, political and institutional characteristics that help to better understand both the clustering and the diversity within this region.

References

Apergis, N. and Cooray, A. (2014). "Tax revenues convergence across ASEAN, Pacific and Oceania countries: Evidence from club convergence". Journal of Multinational Financial Management, Vol. 27, pp. 11-21.

Avi-Yonah, R. S. (2010) "Tax convergence and globalization". Revista tributaria das Americas, Vol. 1, pp. 140-146.

Becker, J. and Elsayyad, M. (2009) "The evolution and convergence of OECD tax systems". Intereconomics, Vol. 44, pp. 105-113.

Bettendorf, L., M. P. Devereux, A. van der Horst, S. Loretz and R. A. de Mooij (2010) "Corporate tax harmonization in the EU". Economic Policy, Vol. 25, pp. 537-590.

Bretschger, L. and Hettich, F. (2002) "Globalisation, capital mobility and tax Competition: Theory and Evidence for OECD Countries". European Journal of Political Economy Vol.18,pp. 695-716.

Carvalho, D. (2014) "Financial integration and the great leveraging". Working Papers, no. w201407, Economics and Research Department, Banco de Portugal. Available at: http://www.bportugal.pt/en-US/BdP%20Publications%20Research/wp201407.pdf

Chen, Y., W. H. Huang and P Regis (2014) "Do Asia and Pacific countries compete in corporate tax rates?" Journal of the Asia Pacific Economy, Vol 19, pp. 25-51.

Cuestas, J. C. and P. J. Regis (2013) "On the relationship between real exchange *rates and external imbalances: East and Southeast Asia".* Sheffield Economics Research Papers, no. 2013015, Department of Economics, University of Sheffield. Available at: http://www.sheffield.ac.uk/polopoly_fs/1.323339!/file/serps_2013015.pdf

Delgado, F.J. and Presno, M.J. (2010) "Tax policy convergence in EU an empirical analysis". Revista de economía mundial, Vol. 26, pp. 53-83.

Devereux, M. P. (2012) "Issues in the design of taxes on corporate profit". National Tax Journal, Vol. 65, pp. 709-730.

Devereux, M. P., Lockwood, B., Redoano, M., (2008) "Do countries compete over corporate tax rates?" Journal of Public Economics, Vol. 92, pp. 1210-1235.

Friedman, M. (1992) "Do old fallacies ever die?" Journal of Economic Literature, Vol. 30, pp. 2129-2132.

Fullerton, D. (1999) "Marginal effective tax rate. In The Encyclopedia of Taxation and Tax Policy". In The Encyclopedia of Taxation and Tax Policy, edited by J. Cordes, R.D.E. and Gravelle, J.G. (Washington, DC: Urban Institute Press) , pp. 249–253. Available at: http://www.taxpolicycenter.org/UploadedPDF/1000538.pdf

Furceri, David. (2005) “β and σ-Convergence: A Mathematical Relation of Causality”. Economics Letters, Vol. 89, pp. 212–5.

Hines, J. R., and Rice, E. M. (1994), Fiscal Paradise: Foreign Tax Havens and American Business. Quarterly Journal of Economics, Vol 109 (1), pp. 149–182.

Jogarajan, S. (2012) “Bilateral tax treaties and ASEAN economic integration: Current position and future prospects”. In N. Sharkey (ed), Taxation in ASEAN and China: Local institutions, regionalism, global systems and economic development, pp. 214-235.

Lam, N M K (2000) "Government Intervention in the Economy: A Comparative Analysis of Singapore and Hong Kong". Public Administration and Development, Vol. 20, pp. 397-421.

Liu, Y. (2014) “Does competition for capital discipline governments? The role of fiscal equalization”. International Tax and Public Finance, Vol. 21, pp. 345-374.

OECD (1998) “Harmful tax competition - An emerging global issue”. OECD Publications, OECD Report, Paris, 1998.

Phillip P.C.B and Sul D. (2007) “Transition modeling and econometric convergence tests”. Econometrica, Vol. 75, pp.1771-1855.

Phillips, P. C. B. and D. Sul (2009) “Economic transition and growth”. Journal of Applied Econometrics, Vol. 24, pp. 1153-1185.

Phua Lye Huat, S and Halkyard, A (2012) "The Impact of Tax Incentives on Economic Development in Singapore and Hong Kong". In N. Sharkey (ed), Taxation in ASEAN and China: Local institutions, regionalism, global systems and economic development, pp. 191-213.

Quah, D. (1993) “Galton’s fallacy and tests of the convergence hypothesis”. Scandinavian Journal of Economics, Vol. 95, issue 4, pp. 427-444.

Robinson, P.M. (1995) “Log-periodogram regression of time series with long range dependence”. Annals of Statistics, Vol. 23, pp. 1048-1072.

Sala-i-Martin (1996) “Regional cohesion: Evidence and theories of regional growth and convergence”. European Economic Review, Vol. 40, pp. 1325-1352.

Slemrod, J. (2004) "Are corporate tax rates, or countries, converging?" Journal of Public Economics Vol. 88, pp. 1169-1186.

Stewart, K. and M. Webb (2006) “International competition in corporate taxation: evidence from the OECD time series”. Economic Policy, Vol. 21, pp. 153-201.

Taugourdeau, E. and A. Ziad (2011) “On the existence of Nash equilibria in an asymmetric tax competition game”. Regional Science and Urban Economics, Vol. 41, pp. 439-445.

Velayos, F., A. Barreix and L. Villela (2008) “Regional integration and tax harmonization: Issues and recent experiences”. In Taxation and Latin American Integration, by Tanzi, V., A Marreix and L. Villela editors, (Inter-American Development Bank, Washington DC).

Wang, D H (2007) "Convergence tests on tax burden and economic growth among China, Taiwan and the OECD countries" Physica A: Statistical Mechanics and its Applications, Vol. 380, pp 278-286.

Young, A. T., M. J. Higgins, and D. Levy (2008) "Sigma convergence versus Beta convergence: Evidence from U.S. County-Level Data". Journal of Money, Credit and Banking, Vol. 40, pp. 1083-1093.

Figure 1: Tax Rate Convergence: Beta Convergence

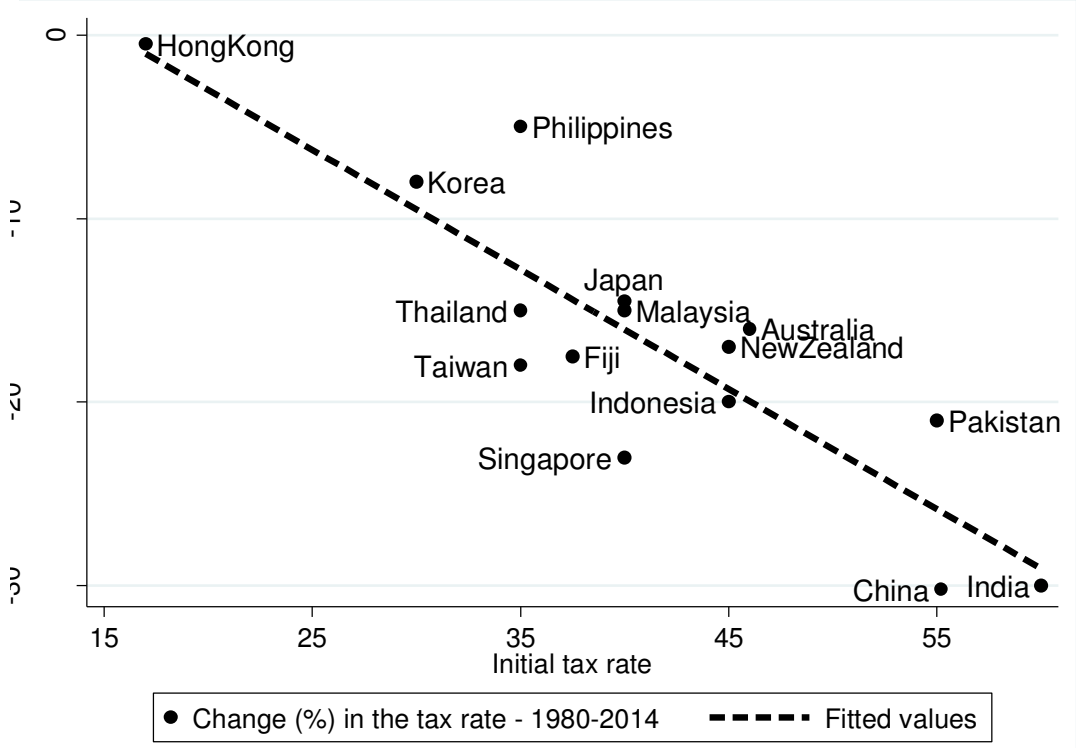


Figure 2: Tax Rate Convergence: Sigma Convergence (full sample)

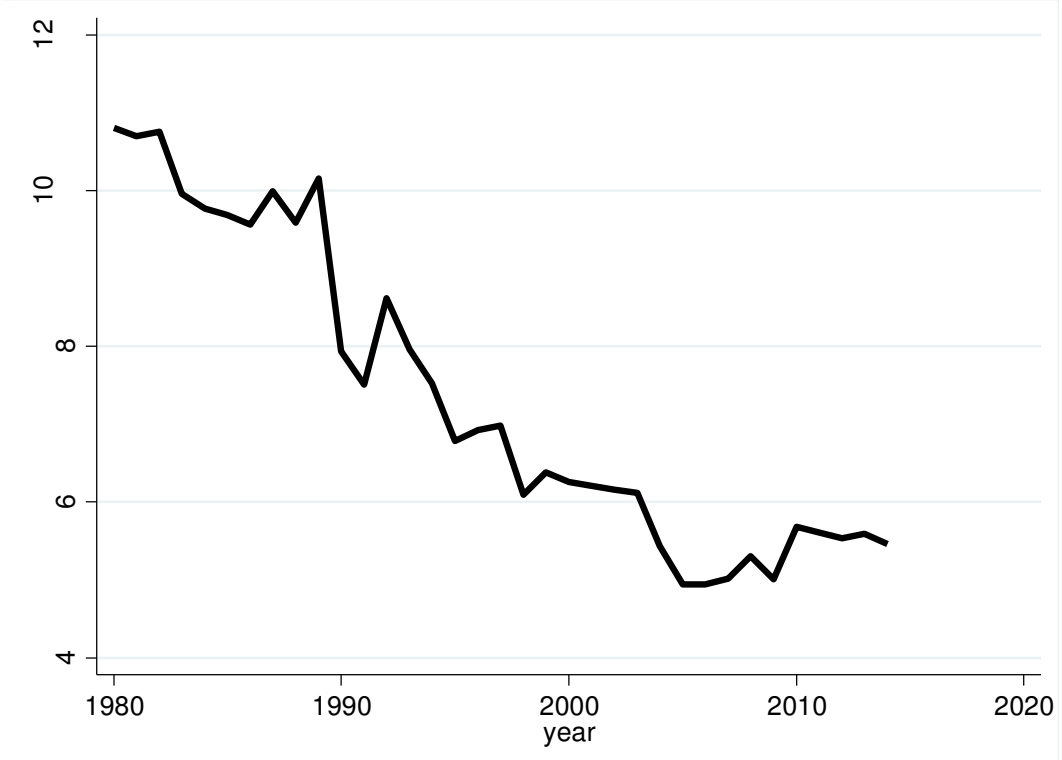
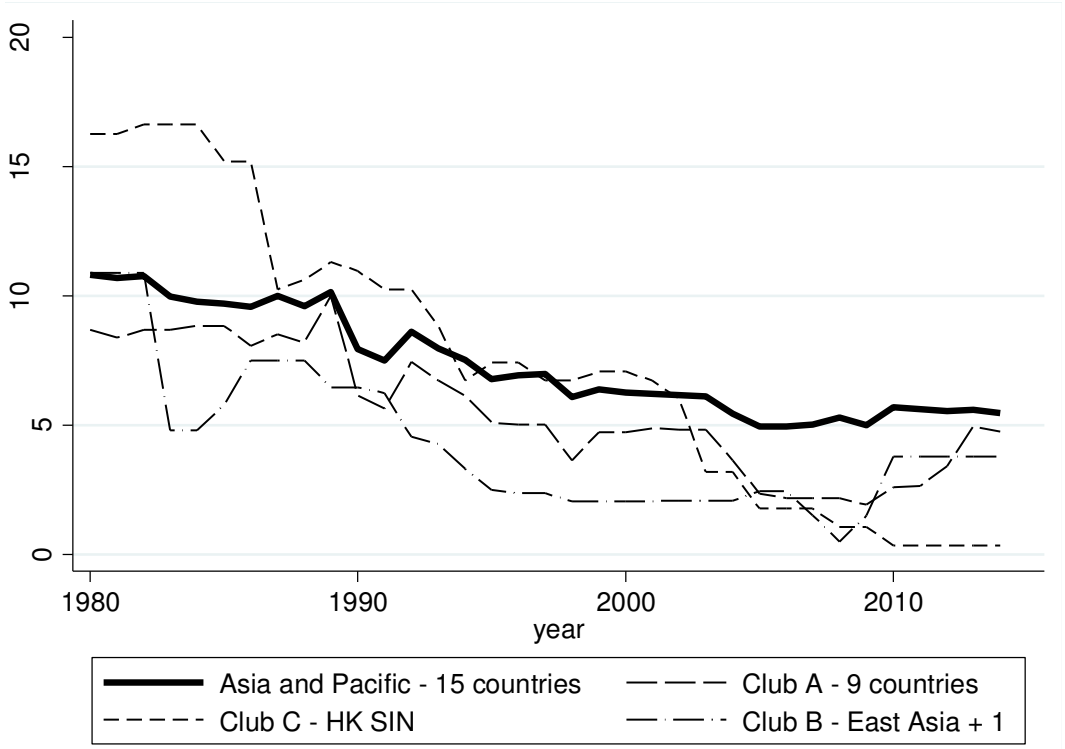


Figure 3: Tax Rate Convergence: Sigma Convergence (within clusters)



Note: The solid line (full sample) is the same as in Figure 2. Sigma convergence is much stronger within clusters than in the full sample, as the three lines converge to zero more rapidly.

Figure 4: Relative Transition Curves (across clusters)

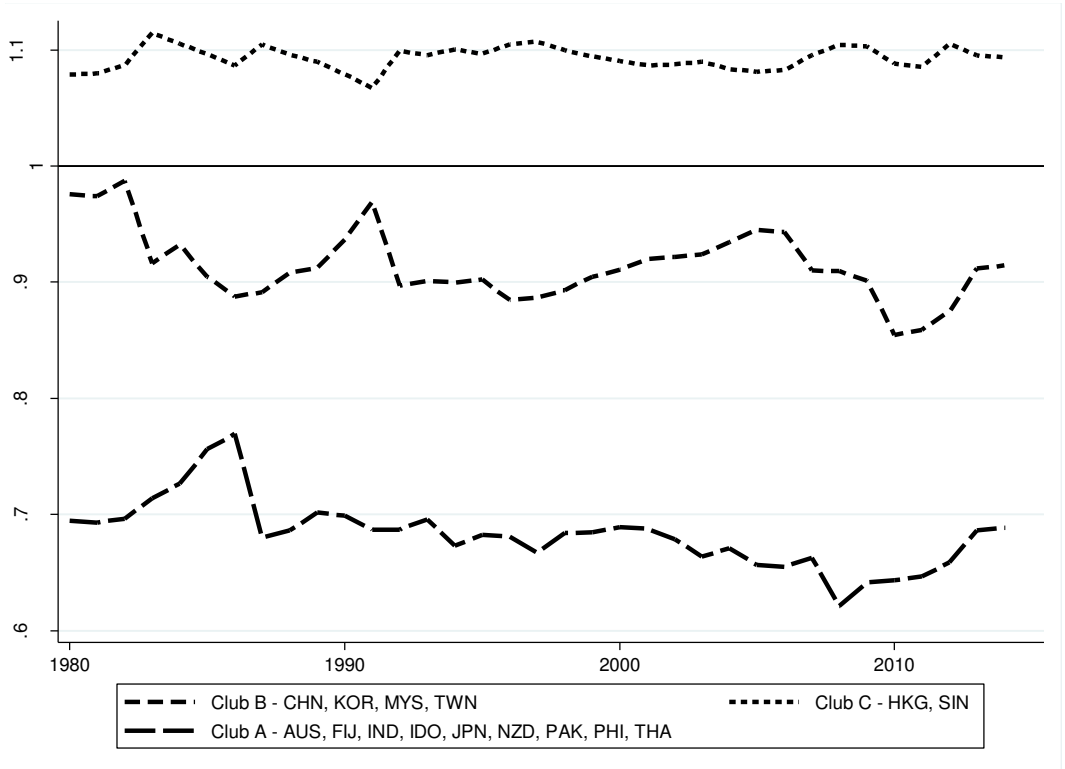
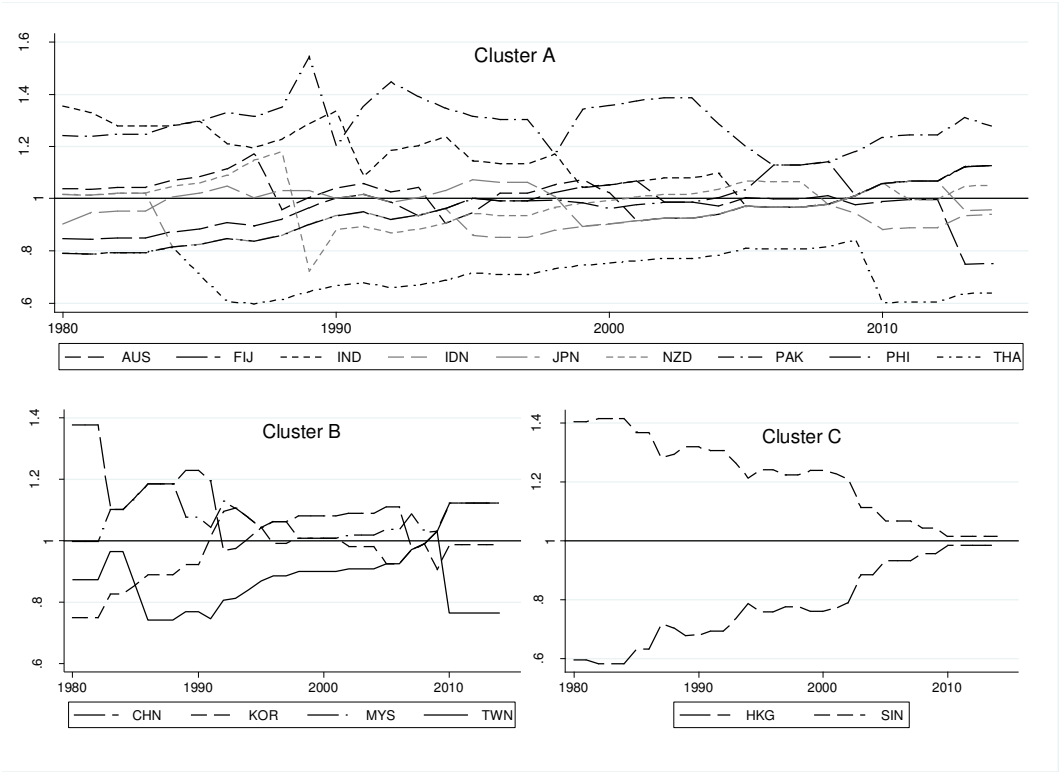


Figure 5: Relative Transition Curves (within clusters)



Notes: Each plot shows the transition parameter within each cluster separately.

Table 1: Summary statistics by country over time

	1980	1991	2002	2014	Mean	St Dev
Australia	46.0	39.0	30.0	30.0	36.3	7.8
China	55.2	40.0	30.0	25.0	37.6	13.3
Fiji	37.5	37.5	32.0	20.0	31.8	8.3
Hong Kong	17.0	16.5	16.0	16.5	16.5	0.4
India	60.0	40.0	35.0	30.0	41.3	13.1
Indonesia	45.0	35.0	30.0	25.0	33.8	8.5
Japan	40.0	37.5	30.0	25.5	33.3	6.7
Korea, Rep	30.0	34.0	27.0	22.0	28.3	5.1
Malaysia	40.0	35.0	28.0	25.0	32.0	6.8
New Zealand	45.0	33.0	33.0	28.0	34.8	7.2
Pakistan	55.0	50.0	45.0	34.0	46.0	9.0
Philippines	35.0	35.0	32.0	30.0	33.0	2.4
Singapore	40.0	31.0	24.5	17.0	28.1	9.8
Taiwan	35.0	25.0	25.0	17.0	25.5	7.4
Thailand	35.0	30.0	30.0	20.0	28.8	6.3
Mean	41.0	34.6	29.8	24.3		
St Dev	10.8	7.5	6.2	5.5		

Table 2: Club convergence

[1]	Tax rate mean [2]	Countries [3]	Sigma converg. test [4]	$\log(t)$ estimator and (t-ratio) Cluster converg. [5]	Cluster merging [6]	Full sample converg. [7]
Cluster A	27.6%	Australia, Fiji, India, Indonesia, Japan, New Zealand, Pakistan, Philippines, Thailand	(-3.74)***	0.291		
				(1.191)	-0.155	
Cluster B	23%	China, South Korea, Malaysia, Taiwan	(-5.35)***	0.315	(-0.874)	-0.394
				(0.622)	-0.201	(-4.085)***
Cluster C	16.8%	Hong Kong, Singapore	(-3.25)***	2.889	(-2.141)***	
				(4.924)		

Notes: Columns have been numbered from [1] to [7]. In the second column, the club average tax rate across the last three years can be found. The last three columns contain the logt convergence test: (within) cluster convergence, cluster merging and overall convergence. In the logt test, a one-sided test with critical values of -2.33, -1.65 and -1.28 (at 1%, 5% and 10% significance levels, respectively), the null hypothesis implies convergence. Column 4 tests for within-cluster sigma convergence, where rejection of the null implies convergence. Sigma convergence is tested through the t-stat of $\hat{b}$ in the following linear regression: $\log(\sigma^2_{Y\,t}/\sigma^2_{Y\,1}) = c + b\log(t) + u_t$, mimicking the logt-statistic (however, note that this is the variance of Y_{it} rather than h_{it} and the $\log[log(t)]$ correction term is not included), where a significant negative trend implies convergence. All values in parentheses are t-statistics with Heteroskedasticity and Autocorrelation Consistent (HAC) standard errors, of Newey-West type (truncation parameter of 3). ***, **, * stand for 1%, 5%, 10% significance levels.

Table 3: Estimated d parameters for each cluster

Cluster A:

Country	Estimated d	t-statistic
Australia	0.707	5.596
Fiji	0.709	5.611
India	0.692	5.477
Indonesia	0.692	5.167
Japan	0.827	6.545
New Zealand	0.630	4.990
Pakistan	0.631	4.996
Philippines	0.783	6.197
Thailand	0.511	4.045

Test for equality of d coefficients: $F(8,207) = 0.53196$; Prob > F = 0.8317

Cluster B:

Country	Estimated d	t-statistic
China	0.742	6.032
South Korea	0.865	7.029
Malaysia	0.772	6.273
Taiwan	0.615	4.997

Test for equality of d coefficients: $F(3,92) = 0.70401$; Prob > F = 0.5520

Cluster C:

Country	Estimated d	t-statistic
Hong Kong	0.609	4.770
Singapore	0.785	6.147

Test for equality of d coefficients: $F(1,46) = 0.9483$; Prob > F = 0.3352

Table 4: Corporate tax, statutory rates in 2013 (%)

Country	Rate	Country	Rate	Country	Rate	Country	Rate
Utd Arab Em	55.0	Uganda	30.0	**AP-Club B**	23.0	**Singapore**	**17.0**
Angola	35.0	Dominican R	29.0	Slovak Rep	23.0	Slovenia	17.0
Argentina	35.0	**New Zealand**	**28.0**	UK	23.0	**Taiwan**	**17.0**
Honduras	35.0	Norway	28.0	Botswana	22.0	**AP-Club B**	**16.8**
Pakistan	**35.0**	South Africa	28.0	Ecuador	22.0	**Hong Kong**	**16.5**
Sudan	35.0	Sri Lanka	28.0	**South Korea**	**22.0**	Romania	16.0
United States	35.0	**AP-Club A**	**27.6**	Sweden	22.0	Canada	15.0
Zambia	35.0	Bangladesh	27.5	Syria	22.0	Georgia	15.0
France	34.4	Italy	27.5	Estonia	21.0	Germany	15.0
Brazil	34.0	Greece	26.0	Luxembourg	21.0	Kuwait	15.0
Venezuela	34.0	Zimbabwe	25.8	Afghanistan	20.0	Latvia	15.0
Belgium	33.0	**Japan**	**25.5**	Armenia	20.0	Lithuania	15.0
Namibia	33.0	Austria	25.0	Cambodia	20.0	Mauritius	15.0
Mozambique	32.0	Bolivia	25.0	Croatia	20.0	Serbia	15.0
Guatemala	31.0	**China**	**25.0**	**Fiji**	**20.0**	Jordan	14.0
Australia	**30.0**	Colombia	25.0	Kazakhstan	20.0	Cyprus	12.5
Costa Rica	30.0	Denmark	25.0	Libya	20.0	Ireland	12.5
El Salvador	30.0	Egypt	25.0	Russia	20.0	Macao	12.0
India	**30.0**	**Indonesia**	**25.0**	Saudi Arabia	20.0	Oman	12.0
Kenya	30.0	Israel	25.0	**Thailand**	**20.0**	Albania	10.0
Malawi	30.0	Jamaica	25.0	Turkey	20.0	Bosnia & Herz	10.0
Mexico	30.0	**Malaysia**	**25.0**	Yemen	20.0	Bulgaria	10.0
Nigeria	30.0	Netherlands	25.0	Czech Rep	19.0	Macedonia	10.0
Papua New G	30.0	Panama	25.0	Hungary	19.0	Paraguay	10.0
Peru	30.0	Portugal	25.0	Poland	19.0	Qatar	10.0
Philippines	**30.0**	Trinidad & T	25.0	Ukraine	19.0	Montenegro	9.0
Spain	30.0	Uruguay	25.0	Belarus	18.0	Switzerland	8.5
Tanzania	30.0	Vietnam	25.0	Chile	17.0	Bahrain	0.0
Tunisia	30.0	Finland	24.5				

Notes: The sample has 111 countries, all of which have a population of half a million or more. Countries in bold feature in our analysis. The average tax rates of the three convergence clubs from Table 2 have also been included.
Sources: OECD and KPMG.