Online Publication Date: 15th June 2012
Publisher: Asian Economic and Social Society

Assessing Determinants of Macroeconomic Policy on Real Convergence and Growth: A Comparative Study of the Eurozone and ASEAN

ZaenalMutaqin (Hiroshima University. 1-5-1 Kagamiyama, Higashi-Hiroshima 739-8529, Japan) and (Sultan AgengTirtayasa University Serang, Indonesia)

Masaru Ichihashi (Hiroshima University. 1-5-1 Kagamiyama, Higashi-Hiroshima 739-8529, Japan)

Citation: ZaenalMutaqin, Masaru Ichihashi (2012) "Assessing Determinants of Macroeconomic Policy on Real Convergence and Growth: A Comparative Study of the Eurozone and ASEAN", Asian Economic and Financial Review, Vol. 2, No. 2, pp. 301-324.

Asian Economic and Financial Review, 2(2), pp. 301-324.

Author (s)

ZaenalMutaqin
Hiroshima University. 1-5-1 Kagamiyama, Higashi-Hiroshima 739-8529, Japan and Sultan AgengTirtayasa University, Serang, Indonesia
E-mail:zaenalmutaqin@hiroshima-u.ac.jp

Masaru Ichihashi
Hiroshima University. 1-5-1 Kagamiyama, Higashi-Hiroshima 739-8529, Japan.
E-mail:ichi@hiroshima-u.ac.jp

Assessing Determinants of Macroeconomic Policy on Real Convergence and Growth: A Comparative Study of the Eurozone and ASEAN

Abstract

This study mainly examines the role of macroeconomic policy variables associated with Maastricht Convergence Criteria (MC), using various approaches to analyze comparatively differences in growth and convergence in income, productivity, and unemployment between a developed, economically integrated area (Eurozone) and a developing one (ASEAN), a decade before and after the euro was introduced. The most interesting issue is whether macroeconomic policy coordination in the Eurozone has had an influence and improves the region's economic performance, compared to a region that does not have such a policy. Based on estimations, convergence was found to be conditional rather than unconditional, except with respect to unemployment and productivity in the Eurozone. Imposing macroeconomic policy variables associated with MC on convergence and growth in the Eurozone and ASEAN makes it possible to determine any significant influence. Although results were mixed in different estimations, in all equations, joint variables imply that those variables should not be ignored in promoting convergence and growth in both regions. Generally, the Eurozone has higher real per-capita GDP, productivity, and unemployment, and more stable growth in GDP and productivity, but ASEAN performed better in terms of growth of income and productivity, and in low unemployment levels, as suggested also by difference-in-difference and decomposition analysis.

Keywords: Convergence; ASEAN; Eurozone; Maastricht Criteria.
JEL:F33, F36, O11, O57

Introduction

ASEAN[1] may be starting to resemble the EU[2] in terms of how it is creating deeper economic integration. Some members of the EU—which consists of 17 member countries that comprise what is otherwise known as "the Eurozone"[3]—have been implementing a European Monetary Union (EMU), while ASEAN's 10 member countries are still in the process of achieving a fully free-trade zone. To create the EMU, EU members needed to agree to surrender their authority vis-à-vis monetary policy and tighten their respective fiscal policies. Their agreement, signed in Maastricht, The Netherlands in 1991, had the main aim of pushing member countries into nominal convergence, which would transform gradually into real convergence (Marelly and Signorelly, 2010). The treaty consists of several criteria popularly called Maastricht Convergence Criteria (MC).[4] In line with this criteria, by

[1]The Association of Southeast Asian Nations (ASEAN) consists of 10 members: Brunei, Cambodia,Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam.
[2]The European Union (EU) consists of 27 members.
[3]"The area" refers to the countries that usethe euro as a common currency.

[4] The MC are (De Grauwe, 2009):
- Inflation rate not more than 1.5% higher than the average of the three lowest inflation rates of EU members

signing a stability growth pact (SGP),[5] Eurozone members have agreed to continuously satisfy the MC, following the logic that wherever the euro is applicable, there had to be consistency of fiscal policy to match the single monetary policy.

Instilling deeper economic integration by creating a common currency was a good idea in terms of protecting the area from financial crisis and economic global uncertainty and increasing its level of convergence; however, the recent financial crisis that hit the Eurozone in 2007–10 raised questions about the future of EMU and the effectiveness of the criteria used to achieve convergence and spur growth. Benassy-Quere and Boone (2010) point out that low growth in the Eurozone resulted from a lack of enforcement vis-à-vis MC compliance and misguided surveillance. However, Irvin (2005) stresses that 1990s growth in the Eurozone was constrained as member countries tightened their budgets to meet MC, as a condition of joining the Eurozone. Hein and Truger (2005) notes that an incomplete synchronization of the business cycle across the Eurozone has also contributed to problems. ASEAN, in intending to implement a full ASEAN economic community (AEC) by 2015—as announced at the Cebu Summit in January 2007 (Shimizu, 2010) —should consider the relevant macroeconomic policy lesson offered by the Eurozone, including the implementation of MC there.

In looking at the data, we find that generally in 1990–2010, the real per-capita GDP and labor productivity of the Eurozone were US$29,054 and US$68,112, respectively—much higher than the ASEAN's figures of US$1,437 and US$19,957 (as calculated from the Unstat and Total Economic Database). However, ASEAN's real per-capita GDP grew three times faster (3.54%, compared to the Eurozone's 1.2%), and its labor productivity grew twice as fast (2.85%, compared to 1.35%). Regarding unemployment rates, ASEAN's performance was better, as seen in the data: during this period it was 5.1% (WDI data), compared to 7.8% in the Eurozone (OECD data).

Low income and productivity growth rates, as well as high levels of unemployment in the Eurozone compared to those of ASEAN, raises questions about the effectiveness of macroeconomic policy in Eurozone with respect to real convergence and growth. Based on the data and the recent crisis in the Eurozone—over a decade after the release of the euro—it is interesting to discover the impact of macroeconomic policy as per the MC on real convergence and economic performance by comparing the region that implemented it with a region that has not. The purpose of this study is to comparatively reassess the determinants of macroeconomic policy on convergence and growth, by comparing the Eurozone and ASEAN.

To undertake this objective, we use the β convergence approach of Barro and Sala-i-Martin (1992), Solow (1956), and other researchers to review the determinants of convergence and economic growth. The study conducted by Soukiazis and Castro (2005) found that macroeconomic policy as per the MC has made contributions, since it contains some restrictive rules vis-à-vis economic policy and institutional orientation. Castro (2010), addressing issues concerning the impact of fiscal criteria within MC on growth, found that the MC's and SGP's fiscal roles did not harm growth. Lombard (2000) confirms that the enforcement of MC has impeded reductions in unemployment. Azali et al. (2007), using an autoregressive distributed lag (ARDL) approach, shows a long-term relationship between variables in the MC and ASEAN growth. Mahmood and Sial (2012), also using ARDL approach, found the

- Long-term interest rate is not more than 2% higher than the average observed in these three low-inflation countries
- Has joined the exchange rate mechanism of the EMS and has not experienced devaluation during the two years preceding entrance to the union
- Government budget deficit is not higher than 3% of its GDP (if it is, it should be declining, to close to the 3%)
- Government debt should not exceed 60% of GDP (if it is, it should diminish to approach the referenced value)

[5]There is an agreement among the Eurozone countries to ensure the stability of the EMU by stressing the implementation of MC in the Eurozone (http://ec.europa.eu/economy_finance/sgp/index_en.htm).

importance of monetary and fiscal policies in determining economic growth. To strengthen estimation results, we investigate comparatively the state of productivity and unemployment in these two areas. Difference-in-difference (DID) analysis was used to support the results concerning differences between the Eurozone and ASEAN after the euro was released; we also used the decomposition approach.

The main contribution of the current study to the literature is that it breaks research ground by comparing growth and convergence in income, productivity, and unemployment between a developed economic integration area (the Eurozone) and a developing one (ASEAN); only Soukiazis and Castro (2005) has examined such issues, and even then it was solely within the Eurozone. As part of a policy evaluation, the current study also seeks to confirm the benefits of imposing MC on a region, by comparing a region subject to MC to another that is not. Some improvements are made in the current study, relative to previous empirical studies; besides its use of the famous β convergence approach, it also uses the DID and decomposition approaches. The results will be beneficial in examining the sustainability of regional integration, based mainly on the Eurozone experience as an ex ante and ex post lesson.The remainder of this paper is organized as follows. Section 2 presents a descriptive analysis, and section 3 describes the theoretical framework and model specification used herein. Section 4 presents the empirical results, and section 5 concludes with the main findings.

Productivity, Unemployment, and Maastricht Variables

Before looking in-depth at convergence, we wish to describe comparatively the recent income, productivity, and unemployment conditions in the Eurozone and ASEAN regions in 1990–2010. Figure 1 reported that the trends of productivity or GDP over labor in these two regions show upward trends. In the Eurozone, the initial level in 1990 was US$57,878, growing 31% to US$75,802 in 2010. In ASEAN, the 1990 figure was US$14,274 and the 2010 figure was US$25,240—a 77% increase. Concerning the unemployment rate, the Eurozone generally had a higher unemployment rate (7.79%) compared to ASEAN (5.06%). Unemployment rates nonetheless fluctuated, with those in the Eurozone reaching their highest point in 1994 and 2010, and those in ASEAN reaching their highest point during the 1997–98 Asian economic crisis.

Figure 2 presents figures pertaining to growth in productivity and unemployment in these two regions. The spread of productivity in the Eurozone was more stable than that in ASEAN. In the Eurozone, the range in rate of growth spreads from a high of 2.59% in 1994 to a low of –2.47% in 2009. The ASEAN trend was more erratic: the top per-capita income growth rate was 9.94% in 1995, decreasing sharply to reach the lowest value just three years later (–5.94%).

As also seen in Figure 2, unemployment rates were more erratic in the Eurozone than in ASEAN. ASEAN experienced its highest rate of unemployment growth (1.48%) in 1999, in line with drops in per-capita GDP and productivity. In the 1990–2008 period, ASEAN's lowest unemployment rate was in 1996 (–0.82%); the Eurozone suffered from high unemployment while ASEAN saw relatively low unemployment rates. The Eurozone's highest unemployment rate (1.91%) was seen in 2009, in line with the debt crisis the region experienced.

In January 2002, the euro was released. The MC became fundamental in ensuring the stability of the euro in the area, and so MC compliance among member countries was essential. In assessing member countries' MC compliance, we sought to measure the current conditions of the Eurozone based on MC requirements. In looking at averaged data from 2002–10 in table 1 and based on inflation criterion, only Slovakia and Slovenia were unable to satisfy the MC; their inclusion in the zone occurred quite late. Regarding the interest-rate criterion, all members satisfy it. With respect to fiscal policy, in looking at the deficit criterion, France, Greece, Ireland, Italy, Malta, Portugal, and Slovakia failed to comply; regarding debt, Belgium, Cyprus, Greece,

Italy, Malta, and Portugal satisfied the arbitrary "60% debt over GDP ratio" criterion. Despite the fact that some members were unsuccessful in satisfying some MC, on average, the Eurozone as a whole satisfied all MC. Concerning the recent crisis in the Eurozone countries, we can straightforwardly state that the inability to satisfy criteria—especially fiscal criteria—has had a contribution. Therefore, for example, Greece faced difficulties in recovering from the current crisis.

Based on descriptive data, the Eurozone can be considered more stable than ASEAN in terms of fluctuation in productivity growth, but the former was more volatile in terms of changes in unemployment rates. Regarding MC compliance, almost all members fulfill the monetary criteria, but many members have been unable to satisfy the fiscal criteria.

Theoretical Framework and Model Specification

Convergence

The main purpose of this study is to investigate real convergence in the Eurozone and ASEAN, as determined by macroeconomic policy related to MC variables; thus, we borrow a popular neoclassical model of economic growth, the Solow model. The study of β convergence is flourishing, as it derives directly the different rates of convergence among various countries in the world, indicating that both poor and rich countries converge to a steady state (Barro and Sala-i-Martin, 2004). This approach was used to predict unconditional and conditional convergence.

Unconditional convergence derives from standard neoclassical growth theory, and it relates to diminishing returns on capital properties (Solow, 1956); it occurs when countries are similar in every respect—with the exception of initial capital stocks, in which case poorer countries will grow more quickly than wealthier ones. All countries are assumed to have access to identical preferences in technology, population, and investment, but differ in their initial levels or per-capita incomes, and in the access support used to foster the process and to grow more quickly. Under such conditions, there is no implication that policies determine economic growth. Based on some studies, unconditional convergence exists only when countries have the same level of economic homogeneity. Following Barro and Sala-i-Martin (1992) the typical unconditional convergence equation could be:

$$(1)\ln y_{i,t} - \ln y_{i,t-1} = \alpha + \beta \ln y_{i,t-1} + v_{i,t}$$

where y is the real per-capita GDP, α is the constant variable, β is the coefficient indicating convergence, t indicates the time interval, (t – 1) is the initial of the time interval, and v indicates the error term. To capture the level of unconditional convergence using the β convergence term, we test the hypothesis that:

$$H_0 = e^{gt} = y^{\beta}{}_{t-1}$$

where e is the exponential and g is the growth.

$$gt = \ln y_t - \ln y_{t-1} = \Delta \ln y_t$$

$$\Delta \ln y_t = \beta \ln y_{t-1}$$

$$\Delta \ln y_t = (1+\beta) \ln y_{t-1}$$

The hypothesis suggests that unconditional convergence holds when the coefficient of the initial dependent variable is negative and between 0 and –1. If $\beta > 0$, then y_t will increase enormously, as if $\beta < -1$.

Conditional convergence derives from new endogenous growth theory that stresses the importance of not only physical capital but also human capital and innovation as determinants of convergence (Barro and Sala-i-Martin, 2004).

Conditional convergence occurs if we control for the determinant of the steady state by relaxing the assumption of diminishing returns to reproducible factors such as human and physical capital accumulation. By relaxing the assumption, the growth becomes endogenous, depending on investment decisions that could thus be determined by policies and institutions. Conditional convergence (i.e., conditional

on the steady state) implies that there is a negative partial correlation between the growth rate and the initial level of per-capita income. In this context, unconditional convergence is not the rule. When underlying differences in technological progress and other factors are controlled in the convergence equation, the initial value of per-capita income is found to be strong and significantly negative, and the theory predicts faster growth for economies that have not yet reached their steady-state value. Since determinants of economic growth differ across countries, Barro and Sala-i-Martin (1992) favor the notion of conditional convergence. The policy and institutional variables in the conditional convergence equation are used as proxies for differences in country steady-state per-capita GDP level. The general model for analysis could be:

$$(2)\ln y_{i,t} - \ln y_{i,t-1} = \alpha + \beta \ln y_{i,t-1} + \gamma X_{i,t} + v_{i,t}$$

In terms of equation (2) a significantly negative β greater than –1 implies that convergence holds conditionally when $\gamma \neq 0$. Bassanini and Scarpetta (2001), investigating OECD countries, summarize a number of studies that assert that the conditioning factors of convergence include the accumulation of physical and human capital, research and development, macroeconomic policy-making, financial development, and international trade. Barro and Sala-i-Martin (1992) concludes that the benchmark rate of convergence based on cross-country studies is about 2% per year; however, panel analysis has shown that the rate of growth was actually higher.

A vast number of studies investigate income or productivity convergence, in either the Eurozone or ASEAN. Ismail (2008) found conditional convergence in the ASEAN-5 and shows that ASEAN had a role in improving its own growth. Chowdhury (2005) found an absence of convergence in ASEAN, in a different study period; that absence was attributed to missing trade links—a circumstance not conducive to long-term economic growth, and perhaps a contributor to weak governance among some ASEAN countries. Vojinovic and Prochniak (2009) confirm the existence of unconditional convergence in the EU-10 countries, while Kaitila (2005) found conditional convergence of labor productivity in the EU-15.

The latter's finding confirms that higher investment, lower public consumption, and lower inflation each contributes positively to growth, but deeper European integration is thought to accelerate growth whenever inflation is not part of the equation. Kaitila (2005) also found conditional convergence among eight central and eastern European countries in 1993–2002, and that higher investment and public consumption supported growth in the area. Bijsterbosch and Kolasa (2010), investigating productivity convergence in central and eastern Europe, pinpoint the existence of convergence and the impact of foreign direct investment inflow.

MC

The use in this study of MC as control variables is based on the policy aim of achieving nominal then, gradually, real convergence (Marelly and Signorelly, 2010). The Maastricht Treaty, signed in 1991, contains some criteria from the Optimum Currency Area (OCA) theory; Mongelli (2005) summarizes the properties of OCA, based on many empirical studies: price and wage flexibility, labor market integration, factor market integration, financial market integration, the degree of economic openness, the diversification in production and consumption, similarities in inflation rates, fiscal integration, political integration, and similarity of shocks. OCA is defined as the optimal geographic domain of a single currency, or of several currencies whose exchange rates are irrevocably pegged and might be unified; this definition is based on the work of Mundell (1961), who first introduced the concept of OCA. The Maastricht Treaty was signed based on the principles of gradualism and convergence criteria. The criteria capture some of the OCA properties, although the treaty has placed more emphasis on macroeconomic convergence criteria. The main reason for this emphasis was to diminish asymmetric shock and increase similarities in policy

responses to shock. De Grauwe (2009) explains the reasons as follows.

Inflation Convergence

This required criterion was based on the fear that a future monetary union would have inflationary bias, if two countries are assumed to be identical except for their authorities' preferences vis-à-vis inflation. Before the EU started, the candidate member countries were asked to prove that they cared about having an inflation rate as low as those of the low-inflation member countries. During this process, a temporary increase in unemployment was inevitable (i.e., a movement along the short-term Philips curve). Self-imposed suffering served as additional evidence for countries concerning lower inflation, and that they were serious about fighting inflation. Once they achieved low inflation rates, they could be safely granted membership. When a common central bank captures the monetary policy of each member, it should reflect the average preference of the participating countries.

Interest Rate Convergence

The justification for this criterion is that excessively large differences in interest rates could lead to large capital gains and losses. Suppose a country wanted to enter the monetary union and at the moment of entry, its interest rate was higher than that of the monetary union zone. As a result, it would be quite attractive for bondholders to sell low-yield monetary union bonds and buy high-yield candidate country bonds. Thus, economic agents holding monetary union bonds would see capital losses, and economic agents holding candidate members bond would see capital gains; either could create disturbances in national capital markets.

Exchange Rate Convergence

The main motivation for this criterion is to prevent countries from manipulating their exchange rates so as to force entry at a more favorable exchange rate (i.e., a depreciated one, which could increase their competitive position).

Budgetary Convergence

High government debt creates an incentive to engineer surprise inflation. Suppose a member country has long-term bonds with an interest rate fixed in a previous period, based on prevailing inflation expectations. If the government were to create unexpectedly higher inflation rates, the real value of these bonds would erode and the bondholders would derive insufficient compensation, because the interest rate on their bonds does not reflect this inflation upsurge. A monetary union between low- and high-debt countries creates a problem for the low-debt country. In the union, the low-debt country will be confronted with a partner who will have a tendency to push for more inflation. As long as one country has a higher debt–GDP ratio, it will have an incentive to create surprise inflation. As a result, the low-debt country stands to lose and force the high debt–GDP ratio country to reduce it. Once this is achieved, the incentives to produce inflation disappear, and the candidate country can be safely allowed into the union.

Relationship between MC and Growth and Convergence

Soukiazis and Castro (2005) investigated the relationships between MC and each of income, productivity, employment, investment, and unemployment convergence in EU-15; they found that for income, there was no absolute convergence, reducing the deficit will be beneficial to the convergence process, and inflation was significant to growth. As with income, there was no absolute convergence in productivity in the Eurozone, and conditional convergence existed when the equation was controlled by MC; together, MC have a significant influence on productivity growth and inflation, and the latter is the only variable to have a consistent negative influence on productivity growth. Also, in using MC as control variables, they found that the EU's unemployment converged both unconditionally and conditionally. A budget deficit has a negative influence on unemployment growth, and Afxentiou and Serletis (2000), using the ordinary least squares (OLS) approach, uncovered the

significance of MC in promoting economic growth.

Papaioannou (2010), investigating the influence of SGP criteria, found that inflation has a significant negative impact on growth; neither a deficit nor debt has any impact. He also found that fulfilling SGP criteria has a positive and significant effect on unemployment. Savona and Viviani (2003) imply that an indifferent budget deficit between current and investment spending limited growth, that public investment contributed positively, that a high interest rate slowed economic growth, that openness was impressive for growth, and that capital formation benefitted growth. Baskaran (2009), using the DID approach, found that joining the EMU has an influence on GDP growth but has no impact on unemployment. Castro (2010), using a dynamic fixed-effect panel, found conditional convergence in EU and that conversion to the euro was not harmful to growth; he also found that variation in inflation has an impact on growth, but only in the long term. The study of Lombard (2000) confirms that the imposition of MC impedes reductions in unemployment. Finally, Azali et al. (2007), using the ARDL approach, showed the long-term relationship between variables in the MC and ASEAN growth.

Brauninger and Pannenberg (2002), estimating the relationship between unemployment and productivity growth through the use of an augmented Solow model, found that an increase in unemployment reduces the long-term productivity level if unemployment has an effect on labor efficiency. Some researchers have also tried to estimate the determinants of unemployment. Ljungqvist and Sargent (2008), investigating the reason for systematically high unemployment in Europe, found that Europe has strong employment protection and generous unemployment insurance provisions.

Tyrowicz and Wojcik (2010), using the β convergence approach, found no unconditional unemployment convergence; they also found rural location not to be significant, youth percentage to be significant, and the percentage of individuals over the age of 50 to contribute negatively. Bassanini and Duval (2006), using panel equations, investigated some macro-level variable shocks and found that the total factor productivity shock and the terms of trade shock, interest rate shock, and labor demand shock each has a significant impact on unemployment. Departing from the existing literature, the current study intends to provide a clear empirical answer to the question of whether the use of MC variables, demographic variables, and typical Barro variables affect assessments of economic growth in ASEAN and the Eurozone, using the following empirical models.

Real Per-Capita GDP

The initial specification of the equation is consistent with the standard neoclassical growth model—including the sole convergence factor, the initial level of per-capita GDP. The first equation tests the hypothesis of unconditional convergence; the extended model involves, additionally, the usual input factor that represents investment, openness, population growth, dummy membership, and dummy crisis. We also follow Soukiazis and Castro (2005) in augmenting MC variables and input variables. For income convergence, the following is the equation of the full model:

$$(3)\ln y_{i,t} - \ln y_{i,t-1} = \alpha + \beta \ln y_{i,t-1} + \gamma_1 DM_{i,t} + \gamma_2 DK_{i,t} + \gamma_3 GK_{i,t} + \gamma_4 GWA_{i,t} + \gamma_5 O_{i,t} + \gamma_6 Inf_{i,t} + \gamma_7 Int_{i,t} + \gamma_8 ER_{i,t} + \gamma_9 Def_{i,t} + \gamma_{10} Debt_{i,t} + v_{i,t}$$

where DM is dummy membership, DK is dummy crisis, GK is growth of capital formation, GWA is growth of working age, O is openness, Inf is inflation rate, Int is interest rate, ER is exchange rate, Def is the deficit ratio on GDP, and Debt is the ratio of public debt to GDP. The countries included in the equation for the Eurozone were all members, and the same was the case for ASEAN.

Productivity Convergence

In the current study, output per worker is used as a proxy to measure productivity. The dependent variable is the growth of productivity in relation to its initial level

(the convergence factor); within the real per-capita GDP convergence equation, we induce the same control variables. The general form of the equation is:

$$(4)\ln p_{i,t} - \ln p_{i,t-1} = \alpha + \beta \ln p_{i,t-1} + \gamma_1 DM_{i,t} + \gamma_2 DK_{i,t} + \gamma_3 GK_{i,t} + \gamma_4 GPop_{i,t} + \gamma_5 O_{i,t} + \gamma_6 Inf_{i,t} + \gamma_7 Int_{i,t} + \gamma_8 ER_{i,t} + \gamma_9 Def_{i,t} + \gamma_{10} Debt_{i,t} + v_{i,t}$$

where p is labor productivity and GPop is population growth. The countries included in the estimation for the Eurozone were all its member countries; for ASEAN, since we faced data limitations, we included only Cambodia, Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

Unemployment Convergence

Recent literature on economic convergence between countries and regions focuses mostly on per-capita income or other related productivity measures. Following Soukiazis and Castro (2005), we borrow the convergence approach to test unemployment convergence in both the Eurozone and ASEAN regions. The dependent variable is the growth of unemployment in relation to its initial level (the convergence factor); within the following per-capita GDP convergence equation, we induce the same control variable. The equation in its general form could be:

$$(5)\ln u_{i,t} - \ln u_{i,t-1} = \alpha + \beta \ln u_{i,t-1} + \gamma_1 DM_{i,t} + \gamma_2 DK_{i,t} + \gamma_3 GK_{i,t} + \gamma_4 GPop_{i,t} + \gamma_5 O_{i,t} + \gamma_6 Inf_{i,t} + \gamma_7 Int_{i,t} + \gamma_8 ER_{i,t} + \gamma_9 Def_{i,t} + \gamma_{10} Debt_{i,t} + v_{i,t}$$

where u is the unemployment rate. The countries included in the equation for Eurozone are all its member countries, while for ASEAN the countries include Brunei, Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

DID Analysis, and Decomposition

To strengthen the econometric results in order to depict the channel regarding income, productivity, and employment, we employ DID analysis to focus on the impact of deeper regional integration (i.e., through the introduction of the euro) on productivity and unemployment growth. The outcome can be calculated by computing a double difference: one over time (before and after) and one across subjects (between beneficiaries and nonbeneficiaries). This method is more feasible than any based on a single difference (either over time or between groups), since examining differences only between beneficiaries and nonbeneficiaries will not reveal the effect of the intervention as readily as examining differences in one group over different time. Based on the approach used by Baskaran (2009), we try to analyze the impact of the release of the euro but looking at the period before and after, with two different subjects: the Eurozone (beneficiaries) and ASEAN (nonbeneficiaries). We do so, using with the following formula:

$$(6)\hat{\Delta} = (\bar{Q}_{eurozone,aftereuro} - \bar{Q}_{eurozone,beforeeuro}) - (\bar{Q}_{ASEAN,aftereuro} - \bar{Q}_{ASEAN,beforeeuro})$$

in which Δ is the DID result and Q is a calculated variable. (The calculated variables in this study were per-capita GDP, productivity, and unemployment.)

In order to acquire a comprehensive understanding of the variables investigated, we use the decomposition approach used by Bloom et al. (2010) to determine the link between per-capita GDP (Y/N) and demographic factors:

$$(7)\%\Delta\frac{Y}{Pop} = \%\Delta\frac{Y}{L} + \%\Delta\frac{L}{WA} + \%\Delta\frac{WA}{Pop}$$

,

where Y, Pop, L, WA, and Δ are income, population, labor, working-age population, and the average annual change, respectively. Through equation (7), we can derive definitions from the left for per-capita income, productivity, participation rate, and working-age population. The analysis used to compare the Eurozone and ASEAN was divided into two periods, 1993–2001 and 2002–09. To acquire a deeper knowledge of productivity, we reformulate the decomposition method used by Blanchard (2004), and its result shows the relationships among productivity, hours worked, and related variables.

$$(8)\%\Delta\frac{Y}{L} = \%\Delta\frac{Y}{HW} + \%\Delta\frac{HW}{Pop} + \%\Delta\frac{Pop}{WA} + \%\Delta\frac{WA}{L}$$

in which HW is hours worked; additionally, Y/HW, HW/Pop, Pop/WA, and WA/L are income per hours worked, hours worked per

capita, working-age population, and working-age labor, respectively. To get the result for the study, we employ data described in table 2.

Result

Econometric Result

Income Convergence

Using equation (3), in line with the findings of Ismail (2008) and Chowdhury (2005) with respect to ASEAN, and with those of Vojinovic and Prochniak (2009), Castro (2010), Soukiazis and Castro (2005), and Kaitila (2005) with respect to the Eurozone, we found that both regions converged only conditionally. As reported in Table 3, conditional convergence in the Eurozone was higher than in ASEAN. The slower convergence speed in ASEAN indicates the large amount of heterogeneity in per-capita income among member countries, as implied by Barro and Sala-i-Martin (2004); as such, richer countries had a higher steady-state value of k (capital), and poorer countries would have no possibility of convergence in an absolute sense.

Conditionally, each country would have a tendency toward more rapid growth, which would exacerbate the gap between its initial level of per-capita income and its own long-term steady-state per-capita income. Convergence would need to progress considerably to be recognized for its different steady-state value, especially between old and new members. Shimizu (2010) shows that some centrifugal forces in intra-ASEAN economic cooperation—such as an unstable domestic political situation—can also contribute to a slow convergence speed in the area. The result does not differ markedly from that of Onwuka, Baharumshah, and Habibullah (2006), who found convergence in ASEAN-5, but ASEAN-10 had no such dissimilar steady state, and income inequality was still apparent there.

The release of the euro started in 2002 for its initial members and continued until 2009 for Slovenia; throughout this period, its release was found to have a positive influence on income growth. For its member countries, joining ASEAN likewise denoted consistent positive estimates in all equations. Both regions suffered from crises—ASEAN in 1998 and the Eurozone in 2009—although this was found to be insignificant in some equations. When input variables were inserted into the equation (column 3), the speed of convergence increased; the Eurozone had a higher speed (27%) than ASEAN (0.9%). Individually, growth of capital strongly pushed income growth in both areas and in all equations, as confirmed by neoclassical theory; openness positively supported only the Eurozone when augmented by MC, but it was not significant in ASEAN. Increasing the working age had a negative role, confirming the population pessimist view proposed by Coale and Hover (1958), since it tends to overwhelm and induce a response by technological progress—a finding in line with that of Bloom et al. (2010).

Examining more deeply the macroeconomic policy variables related to MC, in the Eurozone only, deficit had an impact on income growth, as indicated by the fact that a 1-percentage-point decrease in deficit will push growth by 0.0029 percentage points, as found also by Soukiazis and Castro (2005). In ASEAN only, the exchange rate had an influence whereby a 1-percentage-point depreciation could push growth by more than 0.01 percentage points. Insignificant public debt to some extent confirmed the finding of Reinhart and Rogoff (2010), who suggest that the relationship between debt and growth is strong only if debt exceeds 90% in developed countries or 60% in emerging markets. On average, the Eurozone countries had achieved nominal convergence (confirmed in Table 1) and still satisfied MC and SGP criteria. Although not all MC variables were significant—as also confirmed by Soukiazis and Castro (2005)—the joint significant of all variables was significant. The result also was in line with Mahmood and Sial (2012) indicating the importance of monetary and fiscal policy for growth.

Productivity Convergence

Table 4, based on equation (4), shows that an unconditional β convergence existed in the Eurozone with a convergence rate of 2%,

as shown in column 1; this result aligns with the finding of Vojinovic and Prochniak (2009). When augmented with the dummy membership variable, the rate was slower (1.2%) and joining bore no significance. These findings are in line with those of Lapavitsas et al. (2010), who found that Germany enjoys a higher productivity rate, as it is a country with a flexible labor market that attracts cheap labor from countries such as Greece, Portugal, Spain, and Italy—countries with rigid labor markets and strong labor unions. Incorporating input variables (3), the speed of convergence increased (by 2.1%) the growth of capital, and openness was inducing growth; the population took a value of –1, which is in line with the thinking of Coale and Hover (1958). Among macroeconomic policy variables, inflation as per Soukiazis and Castro (2005), Papaioannou (2010), and Castro (2010) has an impact on productivity growth.

The result implies that a 1-percentage-point increase in inflation reduces growth by 0.2 percentage points. A higher debt ratio could restrain productivity growth, although the impact would be relatively small. The impact of the deficit ratio on productivity growth, in line with the finding of Soukiazis and Castro (2005), was found to be negative. The speed of convergence increases when we incorporate variables into 9.3% (column 4). From the result, we can derive that macroeconomic policy associated with MC has an important role in determining productivity convergence within a region, given its ability to explain variations in productivity growth—as the adjusted R-squared was 45.7% and the joint variables were significant.

The situation with ASEAN is the opposite of that consistent with the neoclassical assumption: no unconditional β convergence exists. This result is in line with that of Chowdhury (2005), and it was significant after incorporating dummy variables. ASEAN membership had no effect in improving productivity, but the crisis was significantly painful for ASEAN. In applying input variables (column 3), the speed of convergence became significant, implying that ASEAN conditionally converged; it did so at a rate of 13.85%. The growth of capital formation and openness had positive impacts as a channel for physical capital and innovation.

Population growth had a negative influence, as suggested by Kelly and Schmidt (1995): the association between population growth and productivity was negative for the positive effects of scale and induced innovation. The augmentation with policy variables indicated that inflation, interest rate, and deficit each had roles. A 1-percentage-point increase in inflation promoted productivity by a very small amount, through the resulting hope of wage increases. The low interest rate could have served as an incentive for money circulation by 0.003 percentage points, thus pushing economic activity and productivity. Comparing all models, we found that policy variables had a great influence in determining productivity growth, since it had adjusted the R-squared value of 45.7%. The result was in line with descriptive data showing that the Eurozone had much higher productivity (US$68,112) than ASEAN (US$29,054). Some interpretations arise thus: the minimum wage is much higher in the Eurozone than in ASEAN, and the labor–capital ratio is much higher in ASEAN—reflecting the state of technology there (Blanchard, 2004), which will attract foreign investment and improve productivity. Although the gap was large (Figure 2), the average growth rate of productivity in ASEAN (3.5%) was higher than that in the Eurozone (1.2%).

Joining the Eurozone had no impact on productivity, but joining ASEAN did have a positive effect. The lack of impact upon joining Eurozone is in line with the results of Castro (2010), who points to the weakness of policy coordination between fiscal and monetary policy, and that there is almost no way of entering a political union that will synchronize fiscal policy, labor, and the welfare system. A possible explanation is offered by Ismail (2008): as ASEAN policy improves openness by implementing an ASEAN free-trade area involving more than 600 million people, it will also improve the productivity of this emerging market. Therefore, ASEAN has a greater potential to grow more quickly than

the Eurozone, where the market has already matured. The impact of crisis on productivity was enormous in both areas; the Asian economic crisis in 1998—as stressed by Mishkin (1999)—was not only economically harmful but also threw the global financial system into a huge recession.

Unemployment Convergence

Table 5 reports the results for the Eurozone: an unconditional β convergence (column 1) existing since the regression result of initial unemployment did not exceed unity and was significantly negative. The rate of unconditional convergence was 17.44%, and was at its highest level when augmented with input variables (12.6%). These results are in line with the findings of Soukiazis and Castro (2005) and Baskaran (2009). Eurozone membership has a positive effect on unemployment growth, and the crisis significantly increased the growth of unemployment. The growth of capital had the significant power to reduce unemployment; this finding is in line with neoclassical theory, since it is beneficial for job creation: a 1-percentage-point increase in capital formation can reduce unemployment growth by more than 0.3 percentage points in all equations.

Trade openness can also help reduce unemployment, since a 1-percentage-point increase in degree of openness can be responsible for a 0.14-percentage-point unemployment reduction. The population growth had no significant impact, since the channel could reflect a general decline in mortality—as implied by Bloom and Williamson (1998)—and may therefore have no influence. The augmentation of Maastricht variables into the basic model indicates that policy adopted to lower the interest rate was responsible for inducing unemployment growth, and that a deficit reduced it. None of the other variables had a significant role. The results align with those of Lombard (2000), who confirms that imposing MC has impediments that reduce unemployment. Maastricht variables were determinant in explaining the fluctuation in unemployment, as the adjusted-R squared was 50.46%.

Table 5 also reports that ASEAN converged either unconditionally or conditionally, since the regression result of the previous unemployment rate was negative and does not exceed unity. The result suggests that the speed of unconditional unemployment convergence was very high, which is consistent with the homogeneity of unemployment rate among member countries. When dummy membership was included in the equation, the result indicated that ASEAN membership had a role in reducing unemployment, indicating that ASEAN policy adopted to induce labor mobility and to increase the degree of cooperation worked in the right direction, toward decreasing the unemployment rate. Crisis was insignificant with respect to the growth of unemployment (Figure 2): in times of crisis, ASEAN's unemployment rate was relatively stable. This finding indicates that the Asian crisis in 1998 mainly hit the financial sector and had no real influence on ASEAN labor, which mainly depended on the agricultural sector.

The highest rates of convergence occurred wherever macroeconomic variables were augmented into the equation. With the augmentation of input variables, only investment was found to make a significant contribution to reducing the growth of unemployment, since it can push job creation. The reverse was true in the Eurozone, where openness was not responsible for fluctuations in the unemployment rate. Population increases did not contribute to changes in unemployment growth in ASEAN, as it had in the Eurozone. Among variables related to MC, we saw that the exchange rate and public debt each had a significant role in determining unemployment rate. Single-point currency depreciation was responsible for 0.25 percentage points of unemployment growth; although the impact was relatively small (0.003), restrictive policy vis-à-vis public debt has had a positive impact in reducing unemployment.

The rate of convergence in ASEAN was higher, both unconditionally and conditionally. For unconditional convergence, the rates in ASEAN and the Eurozone were 42.7% and 17.4%,

respectively. In ASEAN and the Eurozone, the highest rates occurred when the equation was augmented with policy variables (i.e., 57.6% and 12.2%). Thus, with the higher rates denoted in Figures 1 and 2 during 1991–2010, the unemployment rate in Eurozone was 8%, which was higher than that in ASEAN (5%). The volatility of the unemployment rates also implied that ASEAN has more stability. Ljungqvist and Sargent (2008) point out that after the 1970s, unemployment in the Eurozone was persistently high, consistent with the generosity of the welfare system. Other arguments are offered by Lombard (2000) and Bassanini and Duval (2006), who suggest that the high unemployment rate in the Eurozone was often perceived as not only the result of generous unemployment benefits and high minimum wages, but also high hiring and firing costs. Other perspectives pertain to different wage systems and that the strength of labor unions in Eurozone contributed to a lower degree of unemployment convergence (Lapavitsas et al., 2010).

ASEAN membership had a negative impact on unemployment, except after being controlled by MC; Eurozone membership, on the other hand, helped explain the unemployment rate there. Financial crisis was harmful to employment in Eurozone, but this was not the case in ASEAN. In line with theory, the growth of capital formation was a key factor in creating job opportunity and lowering the unemployment rate (Soukiazis and Castro, 2005), as the regression result showed its impact on reductions to unemployment growth in both areas. For the Eurozone, the growth of capital, openness, the interest rate, and the deficit were determinant variables that explain changes in unemployment growth; for ASEAN, among all the variables, only the growth of capital, the exchange rate, and public debt influenced unemployment.

DID and Decomposition

The implementation of a common currency (i.e., the euro within the Eurozone) should be guided by policy, in order to guarantee stability. MC followed by SGP were tools used to ensure the stability of the euro; however, the use of restrictive policy is certainly not without any risk. Therefore, we apply this approach while complementing it with an econometric test. Based on Table 6, looking at the real per-capita GDP results, column 1 shows that the two regions did not differ much in terms of income growth in the decade before the euro was released; however, ASEAN had a 0.99-percentage-point higher income growth than the Eurozone, and that difference grew 3.7-fold in the decade following the euro's release (–3.66%).

The importance of double differencing can be more fully appreciated if the table is read in rows, rather than columns. The first row suggests that Eurozone membership has no real benefit: the average income growth in the Eurozone decreased –1.33 percentage points, while that of ASEAN countries increased by 1.35 percentage points; this results in an overall difference between the two regions of –2.67 percentage points. It could have been that delivering monetary policy to the European Central Bank (ECB) and tightening fiscal policy made it difficult for each Eurozone member to avoid the crisis and to induce growth. The main weakness could have been that fiscal federalism does not allow for addressing regional and structural asymmetries as stressed in the SGP; therefore, income growth slowed. ASEAN policy is often used to induce a free-trade area; one example is the ASEAN Concord II in 2003, with its main goal of forming a single market. We could add that ASEAN has, in total, a 2.67-percentage-point higher growth rate than that in the Eurozone, as a result of not implementing a common currency—an act that comes with it the consequence of policy constraint.

Concerning productivity growth, column 1 in Table 6 shows that, in terms of income, there was a great difference between the two regions in the decade before the euro was released (–1.07 percentage points); that gap doubled in size in the decade after its release (–2.19 percentage points). If the table is read by its rows, the first row suggests that the release of the euro was relatively ineffective in promoting productivity: there was a 0.86-percentage-point decrease in the Eurozone, while ASEAN productivity increased by 0.26 percentage points during that time. The

annual productivity growth in the Eurozone-12 has not successfully increased since the release of the euro.

During the 2002–10 period, it was clear that the countries joining the Eurozone were significantly less economically successful than the ASEAN countries, which did not share a common currency; with respect to trends, the two areas had opposite signs. The DID rating is 1.11, showing that ASEAN—which has none of the economic policy restrictions that come with a common currency—performed better in all periods, with a 1.11-percentage-points higher growth rate. The results are consistent with econometric estimates showing that ASEAN has a higher convergence rate. A possible explanation is that ASEAN, with its lower capital ratio on labor, has an incentive for high capital remuneration, and thus, vast amounts of capital flow into it. As confirmed by econometric estimations, that physical capital has a significant role in inducing productivity growth, a complementary factor in the growth of the labor force. This confluence of circumstances for ASEAN as an emerging market has caused an increase in both the rate of growth and the degree of convergence. The economic role of the euro has been restrictive, suggesting that the stability was causing reductions in the rate of growth.

Focusing on unemployment conditions as reported in Table 6, before the release of the euro, the Eurozone had negative unemployment growth (–0.12 percentage points), which was higher than that of ASEAN (–1.76 percentage points). The opposite conditions happened later: the Eurozone suffered from high growth in unemployment rates and ASEAN experienced large unemployment rate reductions. In examining this table by the row, it becomes clear that the introduction of the euro was painful for the Eurozone, as economic performance vis-à-vis unemployment worsened (i.e., increasing 3.49 percentage points).

The "big picture" of the Eurozone was considerably worse than that of ASEAN, the members of which did not share a common currency; ASEAN performed amazingly with a negative unemployment growth of 3.21 percentage points—quite different from the 4.97 percentage points of the previous period. The overall difference was 8.45 percentage points, indicating that ASEAN's unemployment performance was much better than that of the Eurozone. The result aligns with the unemployment econometric estimation that joining the euro had no positive impact on unemployment. Again, the restrictive economic policy that comes with delivering monetary policy to the ECB and the tightening of fiscal policy behind the stability of the euro have had a hand in these circumstances, since the member countries have found it difficult to resolve unemployment problems.

To be more comprehensive in our research and strengthen previous analysis, we sought to determine a relationship between the per-capita income variable and the population condition. Based on equation (2), we divided the analysis into two periods (i.e., 1993–2001 and 2002–09) and compared the Eurozone and ASEAN.

Table 7 reports that income growth in ASEAN, as supported in the descriptive and DID analyses, was higher than that in the Eurozone, in all periods. In the first period, the growth in ASEAN was higher, supported mainly by growth in productivity. The participation rate vis-à-vis the number of individuals in the labor force declined slightly, since a few subsets of the working-age population chose schooling over working.[6] Working age contributed positively, since high population growth as a result of ASEAN's high birth rate in the early 1980s had translated into a larger working-age population; thus, the impact of working-age population was positive. In the second period, income growth in ASEAN decreased slightly as a result of the impact of lower productivity growth, but it was still higher than that in the Eurozone.

[6]In some cases—for example, Indonesia—policies have been initiated that oblige individuals to partake in a minimum of nine years of schooling.

The contribution of participation rate improved by 0.04 percentage points, and that of working-age population by 0.04 percentage points. The growth of per-capita GDP in the Eurozone was also mainly supported by productivity growth; when productivity growth dropped sharply (i.e., by more than half) in the second period, per-capita GDP also decreased. The participation rate did not change in either period, but the number of working-age people decreased 0.09 percentage points, contributing to lower income growth. The results underscore the important contribution of productivity in supporting per-capita income, as also implied by Bloom et al. (2010). The decreasing trend of participation rate in ASEAN suggests the development of middle and higher-level education systems in ASEAN pushing working-age people to continue schooling in preference to working. Since the Eurozone suffered (and suffers) from an overall aging problem, the contribution of working-age population was close to zero, especially after the 1990s; it will be difficult for those countries to support growth. Unlike in ASEAN, the increase in the number of working-age people and their inclusion in the working-age job market will support further growth in the region.

Since labor productivity played an important role in supporting welfare or per-capita income (Table 7), by reformulating Blanchard's (2004) approach by using equation (8), we can more deeply break down productivity by focusing on labor conditions in the 2001–08 period.

Looking at the first row, during 2001–08, both regions saw an increase in labor productivity. The ratio of working-age growth over labor was growing positively in ASEAN, but it was negative in the Eurozone. The difference could derive from the fact that many working-age ASEAN people prefer to choose schooling rather than enter the labor market, which is the opposite scenario in the aging Eurozone.

The population divided by working age also grew negatively in Eurozone, but it was positive in ASEAN, as a result of ASEAN starting to enjoy age longevity as a result of a lower mortality rate. In terms of hours worked per population, ASEAN experienced lower growth; to some extent, this was caused by the higher population growth in ASEAN, as explained previously. Finally the increase in labor productivity almost completely accounted for the increase in GDP per hours worked; we can somehow interpret that ASEAN workers enjoyed a very high wage increase (4.11 percentage points) compared to their Eurozone counterparts (1.64 percentage points).

The results reported in Table 8 could explain why ASEAN performed better than the Eurozone in terms of growth and convergence in income, productivity, and unemployment. The explanation comes not only from the policy implemented but also from their respective demographic conditions.

.

Conclusion

The current study addressed the issue of the impact of macroeconomic variables implemented in the Eurozone (i.e., MC) on growth and convergence in income, productivity, and unemployment, in the decade before and the decade after the euro was introduced. We presented a comparative study of developed regional integration (i.e., the Eurozone, which implemented MC) with a developing one (i.e., ASEAN). Data showed that the Eurozone had a higher per-capita GDP and productivity, but ASEAN performed better in terms of growth of income, growth of productivity, and low unemployment levels. Income and productivity growth were more stable in the Eurozone, but ASEAN had less fluctuation in unemployment.

Focusing on regression results, convergence was found to be conditional rather than unconditional, except for the case of unemployment and productivity in Eurozone. The ability to explain variation in dependent variables improved substantially when the conditioning factor was included as the magnitude of convergence. Heterogeneity of income and some centrifugal forces in intra-ASEAN economic cooperation, as noted by Shimizu (2010), also had contributions in slowing the speed

of convergence in ASEAN member countries. A lower capital–labor ratio combined with higher growth in productivity, inducing a "catching up" process by which ASEAN derived a comparably higher speed of productivity convergence. Homogeneity in the unemployment rate in ASEAN complemented its different wage system, and the strength of the labor union in the Eurozone could be a determinant of a faster speed of unemployment convergence in ASEAN, as also confirmed by Lombard (2000), Bassanini and Duval (2006), and Lapavitsas et al. (2010).

The augmentation of input variables was essential for all equations. The positive impact of the growth of fixed capital formation aligned with the neoclassical assumption, and the negative impact of population growth on productivity and working age in per-capita income were in line with the assertions of Coale and Hoover (1958), indicating that population growth deteriorates growth and induces responses in the forms of technological progress and capital accumulation. Unfortunately, population growth was found to have no influence on unemployment volatility. Going deeper into the specific impact of macroeconomic policy (i.e., those relating to MC) on growth and real convergence, results were mixed in different estimations. In the per-capita GDP equation, only deficit had a positive influence on growth in the Eurozone, and depreciation had a positive impact on growth in ASEAN.

The Eurozone's productivity estimation result indicated that inflation, deficit, and public debt had negative effects there on productivity growth and on the control of convergence; in contrast, in ASEAN, inflation and deficit each had a positive impact, and the interest rate induced growth negatively. Looking at unemployment convergence, the interest rate had a positive influence and deficit reduced unemployment; for ASEAN, the exchange rate and debt contributed positively to unemployment growth. Due to limitations inherent in the panel estimation, care should be taken with the interpretation of results, since country-specific effects should differ; therefore, country-specific investigations were needed to obtain more robust interpretations. Although individually not all variables relating to MC were significant, in all equations, joint variables were significant, as indicated by the significance of F-stat results. The results implied that those macroeconomic policies associated with MC should not be ignored in promoting convergence and growth.

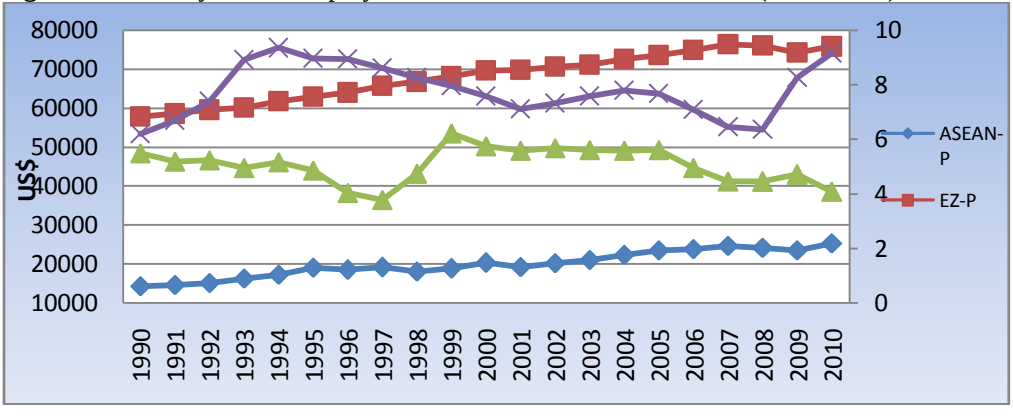
Crisis was painful for both regions, as had been suspected; however, it had no significance vis-à-vis unemployment. The inclusion of a dummy-membership variable wrought mixed results. It was positive in inducing the growth of per-capita GDP in both regions; it was also beneficial in terms of productivity in ASEAN, but insignificant for the Eurozone. It was also beneficial for reducing ASEAN unemployment growth, but enhanced the Eurozone's unemployment growth. What happened in the Eurozone was implied by Lapavitsas et al. (2011), who assert that joining the euro was beneficial for Germany and other core countries, but more peripheral countries incurred losses on account of membership. The data were supported by DID analysis, the overall results of which showed that ASEAN performed better in terms of growth of income, productivity, and unemployment. The comparatively better income performance in ASEAN was supported by higher productivity and an increased number of working-age people, as showed through decomposition. The increase in GDP per hours worked—which could be interpreted as wage—was responsible for the increase in productivity, especially in ASEAN, which experienced high annual growth.

ASEAN member countries have no macroeconomic policy restrictions, and they performed better in terms of income, productivity growth, low-level of unemployment; however, in term of the business cycle, the Eurozone was more stable. With respect to this, the main task of the ECB—as well as the main aim of the MC—is to induce stability in an area (De Grauwe, 2009), and it was certainly headed in the right direction. The MC could sufficiently push countries to achieve convergence. It was difficult to bring about a

political union in the Eurozone; moreover, the Eurozone had asymmetrical monetary and fiscal-policy structures. Therefore, both the MC and the SGP criteria were needed, embedded with incentives to satisfy member countries and clear sanctions relating to lack of compliance.

To ensure a stronger euro, a decade after its introduction, some criteria were set forth in tandem with policy coordination—especially that which imposed price-stability tasks for the ECB and which also pushed growth and mitigated unemployment. ASEAN can learn from the Maastricht Treaty, in terms of how to implement suitable criteria that impose stronger guarantees of economic stability and nominal convergence in an area, as a necessary condition, if ASEAN intends to adopt a common currency. Finally, judging the euro as a mistake was too premature. We make the assertion, along with Marelly and Signorelli (2010), that the satisfaction of MC by the Eurozone member countries brought about slow rates of growth as a result of their need to deliver monetary policy to the ECB and to tighten fiscal policy. However, in the long term, those countries will benefit from the advantages inherent in macroeconomic stability and convergence. Research examining the decade before and the decade after the release of the euro provides us with enough information about real convergence and growth in the Eurozone and ASEAN; however, future comparative research is still needed to capture more definitive answers.

Fig. 1: Productivity and Unemployment Rates: Eurozone and ASEAN (1990–2010)



Note: EZ: Eurozone; P: productivity; and U: unemployment rate. The left axis indicates labor productivity and the right axis unemployment rate.

Sources: Productivity figures were taken from The Conference Board Total Economy Database™, September 2011, http://www.conferenceboard.org/data/economydatabase/, and Eurozone unemployment rate figures are from the OECD Stat online database, while those of ASEAN are from the World Bank, World Development Indicator (WDI).

Fig. 2. Growth of Productivity and Unemployment: Eurozone and ASEAN (1991–2010)

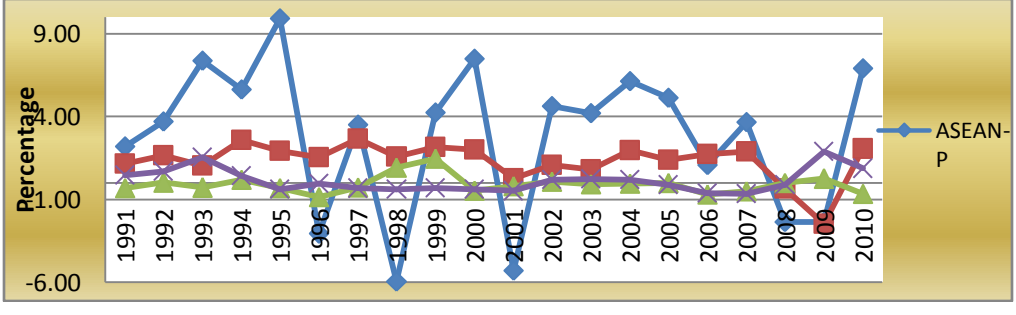


Table-1: MC in the Eurozone (2002–10)

Countries	Inflation	Interest	Deficit	Debt
Austria	1.85	4.03	–2.38	61.54
Belgium	2.04	4.05	–1.62	92.50
Cyprus	2.68	4.87	–2.86	62.54
Finland	1.43	3.97	2.05	37.82
France	1.72	3.96	–4.12	54.88
Germany	1.51	3.80	–2.51	40.59
Greece	3.31	4.99	–7.97	114.78
Ireland	2.24	4.49	–5.30	31.05
Italy	2.10	4.30	–3.53	99.69
Luxemburg	2.21	3.65	0.76	4.30
Malta	2.35	4.79	–4.47	65.81
Netherlands	1.78	3.94	–1.86	44.39
Portugal	2.24	4.36	–3.32	68.01
Slovakia	4.06	4.74	–4.34	33.12
Slovenia	3.73	4.93	–1.86	27.64
Spain	2.71	4.14	–2.30	39.41
Eurozone	**2.37**	**4.31**	**–2.85**	**54.88**
MC	**3.05**	**5.90**	**–3.00**	**60.00**

Source: Author's calculations; see Table 2 for data sources

Table-2: Data Used, and Their Sources

Name	Definition	Source
Per-Capita GDP	GDP/population	Unstat, National Accounts Main Aggregate Database
Labor Productivity	GDP/person employed, in US$	The Conference Board Total Economy Database
Unemployment Rate	Ratio of those unemployment to labor force	World Development Indicator (WDI) and World Bank stats for ASEAN; OECD stats for the Eurozone
Growth of Capital	Growth of gross fixed capital formation	Unstat, National Accounts Main Aggregate Database
Openness	Ratio of export + import to GDP	Unstat, National Accounts Main Aggregate Database
Working Age	Population aged 15–64, as a percentage of total population	World Bank, WDI
Population Growth	Percentage derived from birth rate minus death rate, divided by population	World Bank, WDI
Inflation	Percentage of changing consumer price index (CPI)	World Bank, WDI
Interest Rate	Long-term interest rate	WDI and World Bank stats for ASEAN; OECD stats for Eurozone
Exchange Rate	US$ divided by local currency	Unstat, National Accounts Main Aggregate Database
Deficit	Deficit ratio divided by GDP	WEO stats for ASEAN; OECD stats for Eurozone
Public Debt	Public debt ratio divided by GDP	WEO stats for ASEAN; and OECD stats for Eurozone
Dummy Membership	To capture the effect of membership integration: if a member, then takes a value of 1, and 0 otherwise	www.ecb.int and www.aseansec.org
Dummy Crisis	To capture the effect of a crisis in both areas	

Table-3: Real per-Capita GDP Estimates: Eurozone and ASEAN (1990–2010)

Specification	**1**		**2**		**3**		**4**	
Region	**EZ**	**ASEAN**	**EZ**	**ASEAN**	**EZ**	**ASEAN**	**EZ**	**ASEAN**
Model	**FE**	**FE**	**FE**	**FE**	**FE**	**FE**	**FE**	**FE**
Basic Explanatory Variables								
Constant	1.7713	–0.0658	2.0929[a]	0.1589[b]	2.6678[a]	0.0722	3.5405[a]	0.2542[a]
Per-Capita GDP (–1)	–0.1729	0.0143	–0.2055[a]	–0.0216[b]	–0.2719[a]	–0.0085	–0.3563[a]	–0.0386[b]
Dummy Membership			0.0286[a]	0.0480[a]	0.0198[a]	0.0375[a]	0.0182[a]	0.0175
Dummy Crisis			–0.0527[a]	–0.0808[a]	–0.0111	–0.0738[a]	–0.0152	–0.0697[a]
GK					0.2123[a]	0.0681[a]	0.0994[a]	0.0696[a]
WA					–0.0359[a]	0.0080[c]	–0.0457[a]	0.0049
Openness					0.0955	–0.0102	0.1294[a]	0.0018
Maastricht Variables								
Inflation							–0.0008	–9.61E-05
Interest Rate							–0.0020	–0.0006
Ln Exchange Rate							–0.0223	0.0114[a]
Deficit							0.0029[a]	0.0002
Public Debt							–0.0003	–9.86E-05
Adjusted R-Squared	0.2544	0.2462	0.3022	0.4888	0.4596	0.5604	0.5304	0.5810
F-Statistic (ρ)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
L-R Test (ρ)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hausmann Test (ρ)	0.0000	0.0119	0.0000	–	0.0000	–	0.0000	–
Observations	335	210	335	210	334	210	318	210

Note: a, b, and c denotes values significant at the 1%, 5%, and 10% levels, respectively. EZ: Eurozone; FE: Fixed Effect. Columns 1, 2, 3, and 4 contain unconditional convergence, augmentation with dummy variables, inclusion of input variables, and the full model, respectively.

Table-4: Labor Productivity Estimates: Eurozone and ASEAN (1990–2010)

Specification	**1**		**2**		**3**		**4**	
Region	**EZ**	**ASEAN**	**EZ**	**ASEAN**	**EZ**	**ASEAN**	**EZ**	**ASEAN**
Model	**RE**	**OLS**	**RE**	**FE**	**RE**	**FE**	**FE**	**FE**
Basic Explanatory Variables								
Constant	0.2371[a]	0.0757[b]	0.1558[a]	0.6851[a]	0.2465[a]	1.2862[a]	1.0472[a]	1.8986[a]
Productivity (–1)	–0.0201[a]	–0.0048	–0.0125[b]	–0.0743[a]	–0.0214[a]	–0.1385[a]	–0.0930[a]	–0.1972[a]
Dummy Membership			–0.0029	0.0436[b]	–0.0011	0.0192	0.0009	–0.0273
Dummy Crisis			–0.0364[a]	–0.0891[a]	–0.0248[a]	–0.0687[a]	–0.0348[a]	–0.0525[a]
GK					0.0749[a]	0.0386[a]	0.0454[a]	0.0166
GP					–0.0055[b]	–0.0239[a]	–0.0064[b]	–0.0331[a]
Openness					0.0082[a]	0.0380[b]	0.0225[a]	0.0727[a]
Maastricht Variables								
Inflation							–0.0026[a]	0.0005[c]
Interest Rate							–0.0003	–0.0030[a]
Ln Exchange Rate							–0.0037	–0.0052
Deficit							–0.0006[b]	0.0056[a]
Public Debt							–0.0002[c]	–0.0002
Adjusted R-Squared	0.0467	0.0033	0.1873	0.1987	0.3088	0.3004	0.5057	0.4570
F-Statistic (ρ)	0.0000	0.2253	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
L-R Test (ρ)	0.0183	0.1883	0.0032	0.0142	0.0003	0.0006	0.0000	0.0000
Hausmann Test (ρ)	0.3086	0.0380	0.6031	0.0104	0.1425	0.0007	0.0048	
Observations	336	147	336	147	334	147	318	147

Note: a, b, and c denotes values significant at the 1%, 5%, and 10% levels, respectively. EZ: Eurozone; FE: Fixed Effect; RE: Random Effect; and OLS: Ordinary Least Squares. Columns 1, 2, 3, and 4 contain unconditional convergence, augmentation with dummy variables, inclusion of input variables, and the full model, respectively.

Table-5: Unemployment Estimates: Eurozone and ASEAN (1991–2010)

Specification	**1**		**2**		**3**		**4**	
Region	**EZ**	**ASEAN**	**EZ**	**ASEAN**	**EZ**	**ASEAN**	**EZ**	**ASEAN**
Model	**RE**	**FE**	**FE**	**FE**	**FE**	**FE**	**FE**	**FE**
Basic Explanatory Variables								
Constant	0.3544[a]	0.6030[a]	0.3047[a]	0.9028[a]	0.4250[a]	1.0302[a]	0.3824[a]	–0.1566
Unemployment Rate (–1)	–0.1744[a]	–0.4274[a]	–0.1547[a]	–0.4483[a]	–0.1258[a]	–0.4450[a]	–0.1224[a]	–0.5759[a]
Dummy Membership			0.0039	–0.2820[c]	0.0300[c]	–0.3512[b]	0.0427[b]	–0.1161
Dummy Crisis			0.2106[a]	0.0828	0.0712[b]	–0.0068	0.0501	–0.0800
GK					–0.8063[a]	–0.3754[b]	–0.5164[a]	–0.3200[c]
GP					–0.0200	–0.0299	0.0018	–0.0154
Openness					–0.1453[a]	0.0120	–0.1489[a]	–0.0026
Maastricht Variables								
Inflation							–0.0074	–0.0056
Interest Rate							0.0062[c]	0.0038
Ln Exchange Rate							0.0161	0.2520[a]
Deficit							–0.0135[a]	–0.0028
Public Debt							–0.0006	0.0028[c]
Adjusted R-Squared	0.0896	0.2012	0.1927	0.2108	0.4028	0.2274	0.5046	0.2704
F-Statistic (ρ)	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
L-R Test (ρ)	0.0000	0.0000	0.0327	0.0000	0.0003	0.0001	0.0002	0.0000
Hausmann Test (ρ)	0.0000	0.0000	0.0008	0.0000	0.0001	0.0000	0.0000	–
Observations	316	139	316	139	316	139	305	139

Note: a, b, and c denotes values significant at the 1%, 5%, and 10% levels, respectively. EZ: Eurozone; FE: Fixed Effect; and RE: Random Effect. Columns 1, 2, 3, and 4 contain unconditional convergence, augmentation with dummy variables, inclusion of input variables, and the full model, respectively.

Table-6: DID Estimates of the Impact of the Euro on Income, Productivity, and Unemployment Growth
(Annual average growth rates, in percentage points)

Region	Real Per-Capita GDP			Productivity			Unemployment		
	1993–2001	2002–10	DID	1993–2001	2002–2010	DID	1993–2001	2002–10	DID
Eurozone	1.86	0.53	–1.33	1.79	0.93	–0.86	–0.12	3.37	3.49
ASEAN	2.85	4.19	1.35	2.86	3.11	0.26	1.76	–3.21	–4.97
DID	–0.99	–3.66	–2.67	–1.07	–2.19	–1.11	–1.88	6.58	8.45

Note: For the Eurozone, data exclude Cyprus, Malta, Slovakia, and Slovenia. For ASEAN, productivity figures exclude Brunei, Laos, and Myanmar, and unemployment figures exclude Cambodia, Laos, and Myanmar.

Source: Authors' calculations; see Table 2 for data sources.

Table-7: Real Per-Capita GDP Decomposition(Annual average growth rates, in percentage points)

	Eurozone		ASEAN	
	1993–2001	2002–09	1993–2001	2002–09
Real per-Capita GDP	2.27	1.19	3.36	3.19
Decomposition				
Labor Productivity	1.79	0.78	2.86	2.61
Participation Rate	0.36	0.36	–0.08	–0.04
Working Age to Population	0.13	0.04	0.58	0.62

Note: Authors' calculations, and annual average growth rates, in percentage points.

Table-8: Productivity Decomposition: 2001–08(Annual average growth rates, in percentage point)

	Eurozone*	ASEAN**
Labor Productivity	1.39	5.88
Decomposition		
GDP per Hours Worked	1.64	4.11
Hours Worked Per Population	0.51	0.47
Population Divided by Working Age	–0.02	1.13
Working Age Divided by Labor	–0.75	0.16

Note: *Refers to all members of the Eurozone except Malta; **refers to Indonesia, Malaysia, Philippines, and Singapore, due to data lim itations

References

Afxentiou, Panos and ApostolosSerletis (2000) "Output Growth and Variability of Export and Import Growth: International Evidence from Granger Causality Tests", The Developing Economies, Vol. 38, No. 2, pp. 141–63.

ASEAN Secretary (2011) ASEAN member states available at http://www.aseansec.org

Azali, M., K. S. Wong, Lee C. Kelly,and Ahmad NazarShafinaz (2007) "The ASEAN-5 Future Currency: Maastricht Criteria", Munich Personal RePEc Archive.

Barro, Robert J. and X. Sala-i-Martin (1992) "Convergence", Journal of Political Economy, Vol. 100, No. 2, pp. 223–51.

Barro, Robert J. and X. Sala-i-Martin (2004) "Convergence, Economic Growth Second Edition", The MIT Press, Cambridge, Massachusetts.

Baskaran, Thushyanthan (2009) "Did the Maastricht Treaty Matter for Macroeconomic Performance? A Difference-in-Difference Investigation", Kyklos. Vol. 62, No. 3, pp. 331–358.

Bassanini, Andrea and Romain Duval (2006) "The Determinants of Unemployment across OECD Countries: Reassessing the Role of Policies and Institutions", OECD Economic Studies, No. 42.

Bassanini, Andrea and Stefano Scarpetta (2001) "The Driving Forces of Economic Growth: Panel Data Evidence For The OECD Countries", OECD Economic Studies, No. 33.

Benassy-Quere, Agnes and Laurence Boone (2010) The Euro Zone Crisis: Debts, Institutions and Growth, Le Cercle des Economistes available at http://www.lecercledeseconomistes.asso.fr/IMG/pdf/session_3_Benassy.Boone_Texte_2_en_.pdf.

Bijsterbosch, Martin and MarcinKolasa (2010) "FDI and Productivity Convergence in Central and Eastern Europe: An Industry-Level Investigation", Rev World Econ, Vol. 145, pp. 689–712.

Blanchard, Olivier (2004) "The Economic Future of Europe", Journal of Economic Perspectives, Vol. 18 No. 4, pp. 3–26.

Bloom, D. E., David Canning, Linlin Hu, Yuanli Liu, Ajay Mahal, and Winnie Yip (2010) "The Contribution of Population Health and Demographic Change to Economic Growth in China and India", Journal of Comparative Economics, Vol. 38, pp. 17–32.

Bloom, D. E., & Williamson, J. G. (1998) "Demographic transitions and economic miracles in emerging Asia", World Bank Economic Review, Vol.12, No.3, pp. 419–455.

Brauninger, Michael and Markus Pannenberg (2002) "Unemployment and Productivity Growth: An Empirical Analysis within an Augmented Solow Model", Economic Modelling, Vol. 19, pp. 105–120.

Castro, V. (2010) The Impact of The European Union Fiscal Rules on Economic Growth, Journal of Macroeconomics, DOI: 1016/j.macro.2010.09.003.

Chowdhury, Khorshed (2005) "What's Happening to per Capita GDP in the ASEAN Countries? An Analysis of Convergence", 1960–2001, Applied Econometrics and International Development, Vol. 5 No. 3.

Coale, Ansley J. and Edgar M. Hoover (1958) "Population Growth and Economic Development in Low-Income Countries", Princeton: Princeton University Press

De Grauwe, Paul (2009) Economics of Monetary Union, 8th Edition, Oxford University Press, Oxford.

The European Central Bank(2011) Map of Euro area 1999-2011, available at http://www.ecb.int

Hein, Eckhard and AchimTruger (2005) "European Monetary Union: Nominal Convergence, Real Divergence and Slow Growth?", Journal Structural Change and Economic Dynamics, Vol. 16, pp. 7–13.

International Monetary Fund (2011) World Economic Outlook Databases.

Irvin, George (2005) "The Implosion of The Brussels Economic Consensus", International Centre for Economic Research, Working Paper No. 11.

Ismail, NormazWana (2008) "Growth and Convergence in ASEAN: A Dynamic Panel Approach", International Journal of Economics and Management, Vol. 2, No. 1, pp. 127–140.

Kaitila, Ville (2005) "Integration and Conditional Convergence in the Enlarged EU Area", ENEPRI Working Paper No. 31.

Kelly, Allen C. and Robert M. Schmidt (1995) "Aggregate Population and Economic Growth Correlations: The Role of the Components of Demographic Change", Demography, Vol. 32 No. 4, pp. 543–555.

Lapavitsas, Costas et al. (2010) "Eurozone Crisis: Beggar Thyself and Thy Neighbour" Journal of Balkan and Near Eastern Studies, Vol. 12 No. 4, pp. 321–373.

Ljungqvist, Lars, and Thomas J. Sargent (2008) "Two Questions about European Unemployment", Econometrica, Vol. 76 No. 1, pp. 1–29.

Lombard, Marc (2000) "Restrictive Macroeconomic Policies and Unemployment in the European Union", Review of Political Economy, Vol. 12 No. 3, pp. 317–332.

Mahmood, Tariq, and MaqboolHussainSial (2012), "The Relative Effectiveness of Monetary and Fiscal Policies in Economic Growth: A Case Study of Pakistan", Asian Economic and Financial Review, Vol.1, No.4, pp. 236-244.

Marelly, Enrico and Marcello Signorelly (2010) "Institutional, Nominal and Real Convergence in Europe", Banks and Bank System, Vol. 5, pp. No. 2.

Mishkin, Frederic S. (1999) "Lessons from the Asia Crisis", Journal of International Money and Finance, Vol. 18, pp. 709–723.

Mongelli, Francesco Paolo (2005) "What Is European Economic and Monetary Union Telling Us about the Properties of Optimum Currency Areas?", Journal of Common Market Studies, Vol. 43 No. 3, pp. 607–635.

Mundell, R. A. (1961) "A Theory of Optimum Currency Areas, American Economic Review", Vol. 51, pp. 657–65.

Organisation for Economic Co-operation and Development (2011) OECD Statistics Database.

Onwuka, Kevin Odulukwe, Ahmad ZubaidiBaharumshah, and Muzafar Shah Habibullah (2006) "Trading System and Convergence Hypothesis: Evidence from ASEAN-5 Countries", International Journal of Finance and Economics, Issue 5, pp. 14-28

Papaioannou, George (2010) "Can the Stability and Growth Pact Criteria Lead to Sustainable Growth?", International Research Journal of Finance and Economics, Vol. 5.

Reinhart, Carment and Kenneth Rogoff (2010) Debt and Growth Revisited, Munich Personal RePEc Archive No. 24376.

Savona, Paolo and Carlo Viviani (2003) "The Impact of the Stability and Growth Pact on Real Economic Growth: Automatic Mechanisms or Policy Discretion?", Review of Economic Conditions in Italy, Vol. 2, pp. 263–279.

Shimizu, Kasushi (2010) "ASEAN Economic Integration in the World Economy—Toward the ASEAN Economic Community", Economic Journal of Hokkaido University, Vol. 39, pp. 77–88.

Solow, R. M (1956) "A Contribution to the Theory of Economic Growth", Quarterly Journal of Economics, Vol. 70, pp. 65–94.

Soukiazis, Elias and Victor Castro (2005) "How the Maastricht Criteria and Stability and Growth Pact Affected Real Convergence in the European Union: A Panel Data Analysis", Journal of Policy Modeling, Vol. 27, pp. 385–399.

Tyrowicz, Joanna and PiotrWojcik (2010) "Active Labor Market Policies and Unemployment Convergence in Transition", Review of Economic Analysis, Vol. 2, pp. 46–72.

The Conference Board Total Economy Database™ (2011), available at http://www.conferenceboard.org/data/economydatabase/,

The United Nation Statistic Division (2011) National Accounts Main Aggregate Database.

Vojinovic, Borut and MariuszProchniak (2009) "Divergence Period in the European Convergence Process", Transition Study Review, Vol. 15, pp. 685-700.

World Bank (2012) World Development Indicators

Appendix

Model Development

The analysis of convergence was based on the neoclassical growth theory framework, developed mainly by Solow (1956) and Barro and Sala-i-Martin (1992). We start with the general Cobb–Douglas production function model:

$$(1) Y_{i,t} = K_{i,t}^{\alpha}(A_{i,t}L_{i,t})^{1-\alpha},$$

where $Y_{i,t}$ is the total amount of production of the final good at time t in country i, $K_{i,t}$ is the capital stock at time t in country i, $A_{i,t}$is technology at time t in country i, and $L_{i,t}$ is total employment in country i at time t. Defining $k_{i,t} = K_{i,t}/A_{i,t}L_{i,t}$ as the stock of physical capital per unit of effective labor, and $y_{i,t}= Y_{i,t}/A_{i,t}L_{i,t}$ as output per unit of effective labor in country i at time t, we derive the differential equation:

$$(2) \frac{d\dot{k}_{i,t}}{d_t} = s_i y_{it} - (g + n + \delta)k_{it},$$

where g is the technological progress of A, n is the growth rate of the labor force, and δ is the depreciation of K. The production function in the intensive form could be written as $y_{i,t}= k^{\alpha}_{i,t}$. Then, the intensive form of the steady state of capital is:

$$(3)\ln k_i^* = \frac{1}{1-\alpha}\ln s_i - \frac{1}{1-\alpha}\ln(g_i + n_i + \delta)$$

Substituting the steady state k* we obtain:

$$(4)\ln y_i^* = \ln(A_{i,o}) + g_{i,t} + \frac{\alpha}{1-\alpha}\ln s_i - \frac{\alpha}{1-\alpha}\ln(g_i + n_i + \delta)$$

Following Barro and Martin (1992), the unconditional income convergent equation would be:

$$(5)\ln y_{i,t} - \ln y_{i,t-1} = \alpha + \beta \ln y_{i,t-1} + v_{i,t}$$

where y is real GDP per capita, α is the constant variable, β is the coefficient indicating convergence, t indicates the time interval, (t – 1) is the initial of the time interval, and v indicates the error term. Since the production function in the intensive form can be written as $y_{i,t} = k^{\alpha}_{i,t}$. substituting the steady state k* in (3), we obtain:

$$(6)\frac{Y}{AL_i}^* = (\frac{s}{g+n+\delta})^{\frac{\alpha}{1-\alpha}}$$

Taking the log at both sides:

$$(7)\ln(\frac{Y}{AL_i}^*) = \frac{\alpha}{1-\alpha}\ln s_i - \frac{\alpha}{1-\alpha}\ln(g_i + n_i + \delta)$$

Defining productivity at the steady state as p* = (Y/L)* then:

$$(8)p_i^* = A.(\frac{s}{g+n+\delta})^{\frac{\alpha}{1-\alpha}} = A_0 e^{gt}(\frac{s}{g+n+\delta})^{\frac{\alpha}{1-\alpha}}$$

Taking the log at both sides:

$$(9)\ln p_{i,t}^* = A_0 + gt + \frac{\alpha}{1-\alpha}\ln s_i - \frac{\alpha}{1-\alpha}\ln(g_i + n_i + \delta)$$

Following Barro and Sala-i-Martin (1992), the unconditional productivity convergent equation would be:

$$(10)\Delta \ln p_t = \alpha + \beta \ln p_{i,t-1} + v_{i,t}$$

Recent literature on economic convergence among countries and regions focuses mostly on per-capita income or other related productivity measures. Therefore, like Soukiazis and Castro (2005), I borrowed the convergence approach to test unconditional and conditional convergence in both the Eurozone and ASEAN. The equation for unconditional unemployment convergence was:

$$(11)\Delta \ln u_t = \alpha + \beta \ln u_{i,t-1} + v_{i,t}$$

Since determinants of economic growth differed across countries, Barro and Sala-i-Martin (1992) favored the notion of conditional convergence. The policy and institutional variables in the conditional convergence equation are used as proxies for differences in country steady-state per-capita GDP. The general model for analysis could be:

$$(12)\ln q_{i,t} - \ln q_{i,t-1} = \alpha + \beta \ln q_{i,t-1} + \gamma X_{i,t} + v_{i,t}$$