Policy Mix Coherence Index (PMCI) : A Proposal

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English version

Abstract

From the policy mix theory to the related empirical works, the quantification of the coordination of monetary and fiscal policies seems to be missing. In this paper, we propose an index (PMCI) which measures the coherent nature of the policy mix rather than it restrictive or expansive character. It is defined as the average number of periods that monetary and fiscal policies have been in phase in a Keynesian perspective. After calculating the index for thirty (30) countries over the period 1990 to 2013, we explore the relationship between the policy mix coherence and the stabilization of the activity. The econometric analysis provides empirical evidence that good coordination of monetary and fiscal policies reduces the output volatility.

JEL Codes: C21, C43, E61.

Key Words: Coordination, Monetary policy, Fiscal policy.

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1 Introduction

The economic literature has stressed on the crucial role of the coordination of monetary and fiscal policies (policy mix) since the works of Tinbergen [1952] and Mundell [1962]. The recent global financial crisis has shown the limits of neoliberal ideology. As a consequence, inflation and fiscal balance are no more the chief concern of policy makers. The priority is the economic recovery and the countercyclical economic policies are mobilized with special emphasis on their coordination. Intrinsically related to the stabilization policies, the policy mix is defined in the literature as the joint orientation of monetary and fiscal policies at some point in the economic cycle. The policy mix is said to be countercyclical when there is an upswing in economic activity, its orientation is rather restrictive to prevent overheating, or in the case of economic downturn, it is accommodating to limit the recessionary impact [L'Angevin and Montagne, 2006]. Empirically, several studies have demonstrated outside the context of monetary areas, the issues and the importance of policy coordination in macroeconomic stabilization (Alesina and Tabellini [1987] Villieu et al. [1998] Beetsma and Bovenberg [2001]). In the context of monetary union where monetary policy is conducted by a common central bank, the issue of the policy mix also includes the coordination of fiscal policies of member countries (Klein and Marion [1997] Fatas and Mihov [2002] Gali and Perotti [2003]).

In a comparative analysis of the policy mix in the United States and the Euro zone, L'Angevin and Montagne [2006] have developed a policy mix indicator which summarizes into a single indicator, the interactions of the decisions of the monetary and fiscal authorities on monetary and economic conditions. The indicator measures the restrictive or expansive nature of the policy mix. By construction, the indicator proposed by L'Angevin and Montagne [2006] does not take into account the coherence of the policy mix. Indeed, in the coherence perspective, the two hands of the policy mix must be oriented in the same direction. Thus, similarly to an expansive policy mix, a restrictive policy mix can be consistent according to the position of the economy in the business cycle.

Despite the abundance of theoretical works related to the coordination of economic policies (EP thereafter), the quantification of the policy mix coherence is still missing. This study fills this gap. It enriches the literature by providing an index that measures the degree of the policy mix coherence rather than its expansive or restrictive nature.

Evaluating the degree of coordination of monetary and fiscal policies can be useful for many reasons. On the first hand, a better coordination of EP leads to a better quality of macroeconomic stabilization (Vickers [2000]; Muscatelli and Tirelli [2005]). In monetary union, coordination of EP avoids conflicts of interest between monetary and fiscal authorities. Using game theory, Loewy [1988] and Nordhaus [1994] show that lack of coordination result in suboptimal equilibria. In this context, an index that measures the degree of EP coordination can be useful for policy makers and academic professionals. On the other hand, knowing the degree of EP coordination is a critical step in the dynamics of institutional convergence that ensure the optimality of EP.

The main objective of this study is to develop the policy mix coherence index (PMCI) or the economic policies coordination index (EPCI). The proposed index measures the mean number of periods that monetary and fiscal policies have been in phase in Keynesian perspective. After the construction of the index for a sample of 30 countries over the period 1990 to 2013, the study explores the relationship between the policy mix coherence and the stabilization of the activity. The results of the econometric estimation support the idea that good coordination of EP reduces the volatility of the production. These results highlight the importance of coordination of economic policies and the need for coordination mechanisms of EP especially in monetary union. The rest of the article is organized as follows. Section 2 presents the data and the different steps in the construction of the proposed index. Section 3 sets, implements the methodology and presents the main results: the calculation of the PMCI and the econometric estimation of the relationship between the coordination of EP and the stabilization of economic activity. Section 4 concludes.

2 Methodology and data

In this section, we describe the main steps of the construction of PMCI. Then, we present the data used and their sources. We initially identify the two regimes of the monetary policy evaluated by the monetary conditions index (MCI). Then we do the same exercise for fiscal policy with the structural fiscal balance (SFB). In the last step, we present the calculation of the PMCI.

2.1 Monetary policy

The orientation of monetary policy (MP thereafter) is captured in this paper by the Monetary Conditions Index (MCI). Indeed, from the 1990s, the monetary conditions index (MCI) is used to assess the orientation of the MP[1] due to the fact that in an open economy the interest rate is not the only instrument of MP. Its principle is to synthesize into a single indicator monetary variables (and financial), giving each a weight proportional to its influence on a reference variable interesting the economic policy, for example the activity or inflation [Aubert, 2003]. In the literature, the MCI is defined as the weighted sum of the difference between the logarithm of the real interest rate and its base value, and the difference between the logarithm of the real effective exchange rate (REER) and its base value. Formally the MCI is calculated as follows:

$$MCI_t = \alpha(i_t - i_{base}) + \beta(e_t - e_{base}) \tag{1}$$

where i is the logarithm of the real interest rate[2] and e, the logarithm of the real effective exchange rate. By its construction, an increase (decrease) in MCI from its baseline expresses the restrictive nature (expansive) of the MP.

[1] See Duguay, [1994], Eika et *al.* [1996], Ericsson et *al.* [1998], Verdelhan [1998], Diarisso and Samba Mamadou [2000], Aubert [2003], Dembo Toe [2012], Ary et *al.* [2012].
[2] Since the real interest rate contains both negative and positive values, its value was increased by one unit before logarithmic transformation.

The calculation of the MCI requires determining the weights (α and β) and the choice of a base year. Regarding the choice of the base year, the average values over the analysis period is conventionally retained for lack of an objective reference or equilibrium values (Ary et *al.* [2012]). In determining the weights, two methods are adopted in the literature. On the one hand, the weights of the exchange rate and the interest rate can be estimated by the degree of openness of the economy. This approach relies on the assumption that the exchange rate only impacts foreign trade and interest rates impact domestic demand [Dembo Toe, 2012]. The second approach that we choose in this paper is an econometric estimation. We follow the approach of central banks (Canada, France, WAEMU zone) by deducting the parameters α and β from the estimation of the relationship between aggregate demand (change in real GDP, Δy_t) and the two instruments of the PM (i_t and e_t).

$$\Delta y_t = a_1 i_t + a_2 e_t + \varepsilon_t \tag{2}$$

where ε_t is an error term. Equation 2 is estimated by ordinary least squares (OLS) if the variables are stationary. In the case that the variables are not stationary, the equation 2 is estimated on the basis of an error correction model (ECM). In this paper, all the variables taken into difference are stationary, allowing us to estimate the equation by ordinary least squares (OLS). The estimated equation is as follows:

$$\Delta y_t = a_1 \Delta i_t + a_2 \Delta e_t + \varepsilon_t \tag{3}$$

The estimated coefficients $\hat{a}_1$ and $\hat{a}_2$ are used to determine the weights α and β as such:

$$\alpha = \frac{\hat{a}_1}{\hat{a}_1 + \hat{a}_2} \text{ and } \beta = \frac{\hat{a}_2}{\hat{a}_1 + \hat{a}_2} \tag{4}$$

With the MCI, we determine the different regimes of the MP as follows: MP is restrictive if the MCI is above its median value. It is expansive otherwise. The choice of the median rather than the mean is justified by the fact that it is less sensitive to outliers. We build the variable $S_{m,t}$ as follows:

$$S_{m,t} = \begin{cases} 1 & \text{if } ICM_t < ICM_{median} \\ 0 & \text{if } ICM_t \geq ICM_{median} \end{cases}$$

The variable $S_{m,t}$ which describes the two regimes of the monetary policy will be used in the construction of the PMCI. It is equal to 1 if monetary policy is expansive and 0 otherwise.

2.2 Fiscal policy

The indicator generally used to describe the direction of the fiscal policy (FP thereafter) is the change in the cyclically adjusted fiscal balance (L'Angevin and Montagne [2006]). Indeed, the change in the actual public finance balance depends on the policy choices but also of economic activity, revenue and public spending is sensitive to changes in economic cycle. The global deficit is thus traditionally divided into two components, the structural deficit on the first hand[3], which

[3] Bouthevillain and Garcia [2000] provide a summary of the various evaluation methods of the structural deficit.

reflect the impact of the economic policy choices, and on the other hand the cyclical deficit, related to the position of the economy in the business cycle (Garcia and Verdelhan [2001]).
Other indicators are also used in the literature, such as the primary fiscal balance. In this paper the orientation of FP is captured by the structural fiscal balance (SFB). It is calculated as the estimated residual of the equation that links the fiscal balance (FB) to the cyclical component of real GDP. The cyclical component of real GDP (output gap) is obtained using the well-known Hodrick-Prescott filter with a smoothing parameter equal to 100. We estimate the following equation:

$$FB_t = \lambda OG_t + \mu_t \tag{5}$$

where OG_t represents the output gap and μ_t an error term that represents the component of the fiscal balance that is not affected by the economic cycle ($SFB_t = \mu_t$). However this approach of determining the structural fiscal balance (SFB) suffers as shown by Cette and Jaillet [1998] of the uncertainty on the calculation of the output gap and the non-consideration of the influence of the deficit on the activity. Therefore we estimate the equation 5 using the Two Stage Least Squares (TSLS) method to eliminate the influence of the fiscal balance (SB) on the economic cycle. The variable OG_t is instrumented by its lagged values.
With the structural fiscal balance (SFB), we construct the variable $S_{f,t}$ as follows:

$$S_{f,t} = \begin{cases} 1 & \text{if } SFB_t < 0 \\ 0 & \text{if } SFB_t \geq 0 \end{cases}$$

The FP is restrictive if $SFB_t \geq 0$ and expansive otherwise. The variable $S_{f,t}$, which captures the two regimes of FP will be used in the construction of the PMCI.

2.3 Calculation of the PMCI

The policy mix coherence index (MPCI) or the economic policy coordination index (EPCI) we propose measure the degree of coherence of the policy mix during a period. In the literature, the policy mix is coherent if both EP are moving in the same direction with respect to a given target, generally the activity or inflation. For example, in a Keynesian perspective the MP should be expansive when the FP is also expansive. Similarly, if the activity is overheating the policy mix is said coherent if both EP are restrictive. It is described as (non)coherent over the same period, if the MP is expansive (restrictive) while the FP is restrictive (expansive). Using the variables $S_{m,t}$ and $S_{f,t}$ defined previously, we construct a third variable $S_{mf,t}$ as such:

$$S_{mf,t} = Max\left\{(1-S_{m,t})(1-S_{f,t}) \ ; \ S_{m,t}S_{f,t}\right\} \tag{6}$$

In other words:

$$S_{mf,t} = \begin{cases} 1 & \text{if } S_{m,t} = S_{f,t} \\ 0 & \text{if } S_{m,t} \neq S_{f,t} \end{cases}$$

Thus, if the policy mix is coherent $S_{mf,t}$ is equal to 1 and if the policy mix is (non)coherent then $S_{mf,t}$ is equal to 0. Formally the policy mix coherence index (PMCI) is defined as the average number of periods in which the policy mix has been coherent, namely:

$$\begin{aligned} MPCI &= \frac{1}{T}\sum_{t=1}^{T} Max\left\{(1-S_{m,t})(1-S_{f,t})\ ;\ S_{m,t}S_{f,t}\right\} \\ &= \frac{1}{T}\sum_{t=1}^{T}[(1-S_{m,t})(1-S_{f,t})+S_{m,t}S_{f,t}] \\ &= \frac{1}{T}\sum_{t=1}^{T} S_{mf,t} \end{aligned}$$

with $S_{m,t} = [0;1]$ and $S_{f,t} = [0;1]$. By construction, the PMCI is comprised between 0 and 1. The index is 1 in case of perfect coordination of monetary and fiscal policies. When it is set to 0, the index reflects a lack of coordination of EP on the considered the time period T. The PMCI can be calculated on a period of one year or more. Over a period of a year, it takes the value 0 or 1.

2.4 Data

The data used in this study covered a sample of 30 countries over the period 1990 to 2013. The sample composition is conditioned by the data availability. The data of the fiscal balance and real GDP are taken from WEO 2013 database (World Economic Outlook). The real interest rate data and real effective exchange rates are those of the WDI 2014 (World Development Indicators).

3 Results

In this section, we highlight the main results. We present initially the results of the calculation of the PMCI according to the method described above. Then the results of the econometric analysis of the relationship between the policy mix coherence and the stabilization of activity are presented.

3.1 Policy mix coherence index

The results of the calculation of PMCI are presented in Table 1. Over the period 1990 to 2013, Burundi is the country where the coherence of the policy mix was more marked with a PMCI of about 0.8421. In other words, on the annual basis, monetary and fiscal policies have been in phase in 84% of cases. In the sample considered, Singapore is the country where the PMCI was the lowest with an index of 0.25. Three (3) out of four (4) times, the policy mix have been (non)coherent over the period of the study. Chile is the only country where the policy mix index equals 50% over the study period.
Descriptive statistics of the PMCI are also presented in the last row of Table 1. The PMCI sample average is 0.5971 while the median of the index is 0.6139. These statistics suggest that on

Table 1: Results of the calculation of the PMCI over the period 1990 to 2013

Rank	Country	PMCI	Rank	Country	PMCI
1	Burundi	0.8421	16	St. Lucia	0.6087
2	Antigua and Barbuda	0.8333	17	Bahamas	0.5833
3	Iceland	0.8333	18	Canada	0.5833
4	United-Kingdom	0.7917	19	China	0.5833
5	Colombia	0.7500	20	Australia	0.5417
6	Italy	0.7500	21	Paraguay	0.5417
7	Mexico	0.7143	22	Chile	0.5000
8	Grenada	0.7083	23	Salomon Island	0.4783
9	Japan	0.7083	24	Bahrain	0.4583
10	Lesotho	0.7083	25	Papua new guinea	0.4583
11	Malaysia	0.7083	26	Algeria	0.4000
12	St. Kitts and Nevis	0.6667	27	Bolivia	0.3750
13	Dominica	0.6250	28	Switzerland	0.3333
14	Vct and Grenadines	0.6250	29	Venezuela	0.3333
15	Fiji	0.6190	30	Singapore	0.2500
Obs	Mean	Min	Max	Std deviation	Median
30	0.5971	0.2500	0.8421	0.1601	0.6139

Source : author's calculation

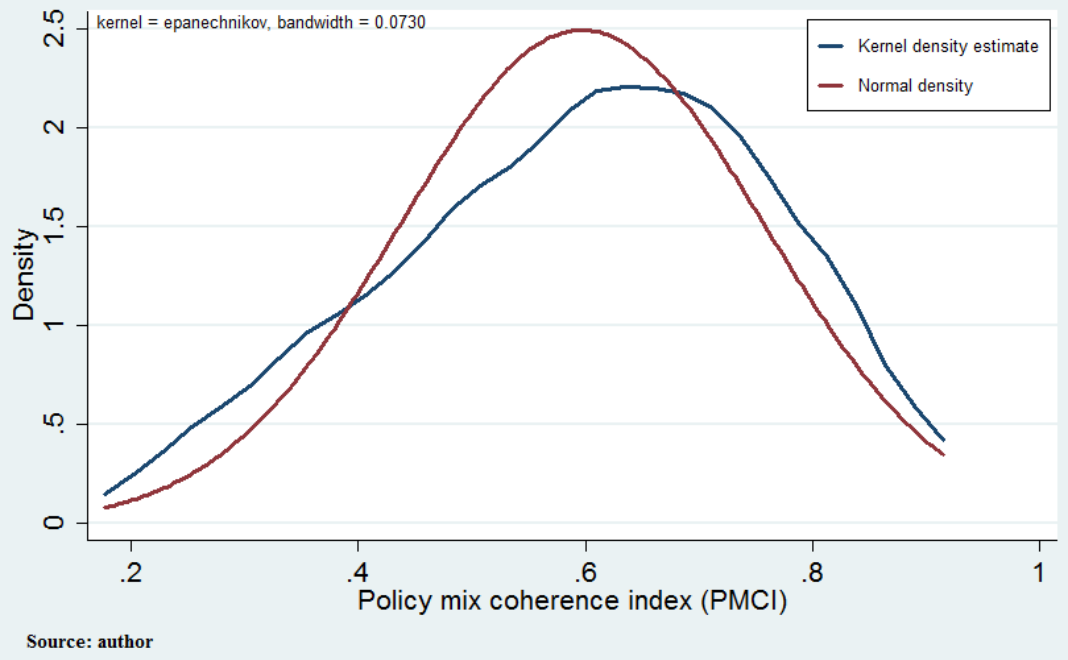

Figure 1: Kernel density estimate of the PMCI compared to a normal density

average and for the sample countries, the policy mix was slightly more coherent over the period 1990 to 2013. The variability of the PMCI from one country to another captured by the standard

deviation of the sample, is 0.1601. The results also show that the coordination of monetary and fiscal policies have been relatively good (PMCI greater than or equal to 0.75) in six (6) countries out of 30, or 20%. It is also noted that 27% of the sample countries have a PMCI less than 0.5. We summarize the following statistics in Figure 1. This is the estimated kernel density (Epanechnikov) of the PMCI. This graph suggests a uni-modal distribution with a shape close to a normal one.

3.2 Does coherent policy mix promote economic stabilization ?

After the construction of the PMCI, we try to analyze the relationship between the policy mix coherence and stabilization of economic activity. Since the works of Tinbergen [1952] and Mundell [1962], particular importance is given to the coordination of economic policies. The IS-LM model is the theoretical framework that illustrates the impact of the monetary and fiscal policy coordination on short-term economic activity. According to the literature, if a country has low growth and inflation, the policy mix should be broadly expansive. If a country is experiencing a strong economic growth, his policy mix must become progressively more restrictive [Artus, 2014] and in this context, the policy mix coherence is crucial for better effectiveness of the stabilization of the activity.

Our objective in this section is to evaluate empirically the impact of the coherence of the policy mix on output volatility. Does coherent policy mix promote economic stabilization ? To address this issue, we propose a cross section model specified as follows:

$$\tilde{Y_i} = c + \gamma PMCI_i + \theta \tilde{X_i} + \mu_i \tag{7}$$

where c is a constant, $\tilde{Y_i}$ a measure of the volatility of real GDP, $\tilde{X_i}$ a vector of control variables and μ_i is a classic error term. The term μ_i represents also all other variables of the economy that can influence the production volatility and which are not explicitly taken into account in the model. γ and θ are parameters to be estimated. The volatility of the output is measured by the coefficient of variation of real GDP, it means its relative variability. This is justified by the fact that the treated sample is composed of economies with relatively different sizes. It is calculated as follows:

$$\tilde{Y_i} = \frac{\sigma_{Y_i}}{\bar{Y_i}} \tag{8}$$

where σ_{Y_i} and $\bar{Y_i}$ respectively represent the standard deviation and the average of the real GDP of the country i over the study period. The vector $\tilde{X_i}$ is composed of the following variables: the volatility of the real effective exchange rate ($VREER$), the volatility of real interest rates ($VRIR$) and the volatility of fiscal balance (VFB). Control variables are also transformed into coefficients of variation using the same Formula 8. The variable of interest in this analysis is the PMCI. We expect a negative sign of it coefficient γ following the idea that good coordination of EP reduces output fluctuations. We implicitly assume that (1) the policy mix is restrictive in case of overheating and expansive in case of activity slowdown and (2) the transmission channels

of monetary and fiscal policies are operational. Before presenting the estimation results, we represent on a graph the couples of PMCI and the coefficient of variation of real GDP of our sample. Figure 2 suggests a negative relationship between the PMCI and the volatility of real GDP. This first result is confronted to the results of the econometric estimates.

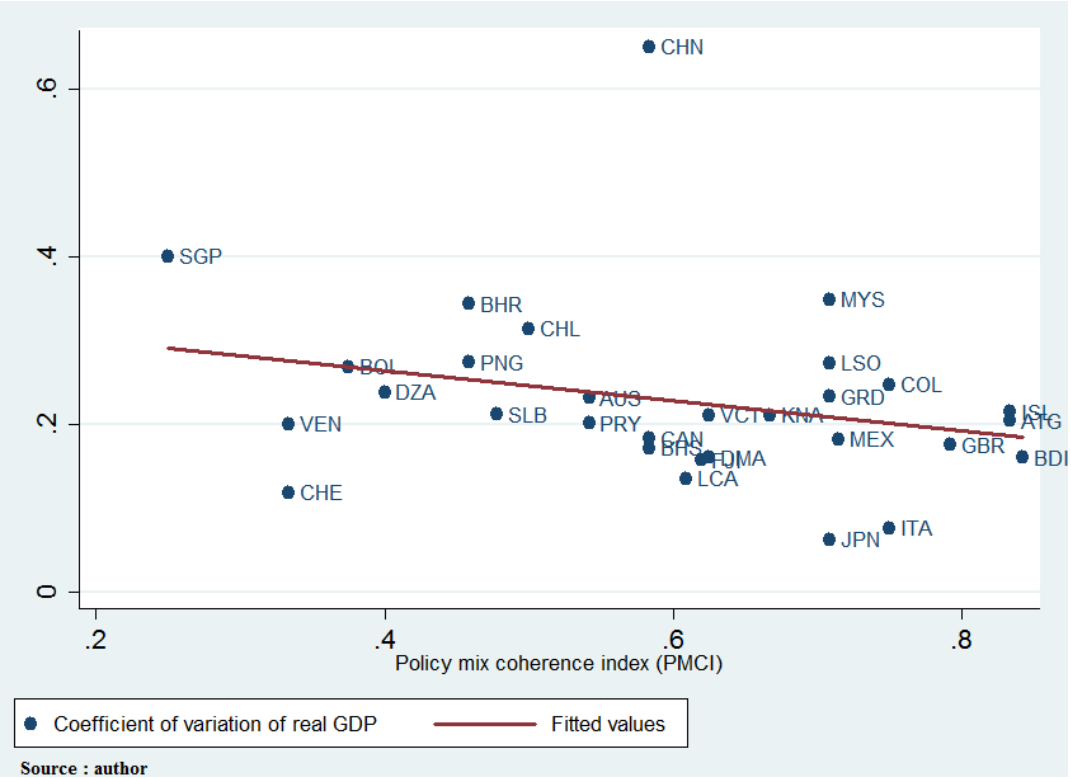

Figure 2: The relationship between the PMCI and the coefficient of variation of the real GDP

The estimation of the model 7 is initially carried out by the ordinary least squares (OLS) method and taking into account the heteroskedasticity problem by the method of White [1980]. Estimation results are presented in Table 2. Majors evidences: we note the significance of 10% of the coefficient γ with the expected sign except with the model [5]. This result is orthodox and confirms the relationship from the graphical analysis. However, the significance of the coefficient γ is gradually altered with the inclusion of control variables. The quality of the regression or the explanatory power of the models is week with an R^2 of the order of 7%. It should be noted that the objective here is not to analyze the determinants of the volatility of production. It is simply an exploratory analysis of the relationship between the policy mix coherence and output volatility. The other variables are not statistically significant. The results suggest that a coherent policy mix seems to reduce output volatility.

We continue the analysis by noting that the OLS estimators are sensitive to the presence of observations that lie outside the norm. The sensitivity of conventional regression methods to

Table 2: Estimation results with the OLS method, robust standard errors

Models	[1]	[2]	[3]	[4]	[5]	[6]
$PMCI$	-0.1797*	-0.1777*	-0.1797*	-0.1827*	-0.1789	-0.1842*
	(0.078)	(0.095)	(0.097)	(0.070)	(0.113)	(0.100)
$VREER$		0.0809			0.0840	0.5957
		(0.661)			(0.672)	(0.771)
$VRIR$			0.0001		-0.0001	-0.0003
			(0.995)		(0.898)	(0.756)
VFB				0.0028		0.0025
				(0.539)		(0.631)
Obs	30	30	30	30	30	30
R^2	0.069	0.072	0.069	0.073	0.072	0.074
( ) significance probability of parameters. Intercept included, but not reported						
(***), (**), (*) respectively significants at 1%, 5% et 10%						

Source : author's estimation using Stata

these outlier observations can result in coefficient estimates that do not accurately reflect the underlying statistical relationship between the variables of the model. We recognize that the economies of our sample are not homogeneous which can cause the presence of outliers. Indeed, as evidenced by the graph 2 we note the presence of outliers (for example, there is a volatility of real GDP relatively high for China over the period 1990-2013). Therefore, we mobilize the robust least squares (RLS) method [4] following the iterative approach of Huber [1965] which takes into account this problem. This method eliminates if necessary the identified outliers. The results are

Table 3: Estimation results with the robust least squares method

Models	[1]	[2]	[3]	[4]	[5]	[6]
$PMCI$	-0.1644*	-0.1488	-0.2281**	-0.1688*	-0.2565**	-0.2582**
	(0.081)	(0.121)	(0.030)	(0.079)	(0.014)	(0.017)
$VREER$		0.1338			0.3546	0.3433
		(0.514)			(0.138)	(0.189)
$VRIR$			0.0135		0.0241*	0.0237*
			(0.247)		(0.072)	(0.091)
VFB				0.0033		0.0008
				(0.539)		(0.907)
Obs	30	30	29	30	29	29
Prob > F	0.0814	0.2277	0.0841	0.1931	0.0660	0.1403
( ) significance probability of parameters. Intercept included, but not reported						
(***), (**) , (*) respectively significants at 1%, 5% et 10%						

Source : author's estimation using Stata

presented in Table 3. They are qualitatively similar to those obtained by OLS. The coefficient γ is significant in all regressions except in model [2]. The countries that have the most coordinated economic policies tend to have low output volatility. The coefficient of real interest rate volatility

[4] For a detailed presentation of the method, see Hamilton [1991].

is significant at 10% with the expected sign in the models [5] and [6]. The output volatility seems to be positively related to the interest real interest rate volatility. However, this result is not robust. The other variables of the model are not statistically significant.

4 Conclusion

The policy mix, a concept originally drawn from the Keynesian theory, still have today practical applications even in monetary unions. The coexistence of fiscal and monetary supports to economic activity raises the question of the coordination of these two policies for optimal impacts. In the extensive literature of the coordination of monetary and fiscal policies, the quantification of the policy mix coherence is still missing. The indicator proposed by L'Angevin and Montagne [2006] measures only the expansive or restrictive nature of the policy mix. In this study, we were interested to the evaluation of the degree of the policy mix coherence in a Keynesian perspective. The proposed index, denoted PMCI, is defined as the average number of periods that monetary and fiscal policies have been in phase. The index can be used as a benchmark and at the same time guide the economic policy makers in the coordination process of their actions. In the academic domain, it can be mobilized in empirical work on economic policy coordination. After calculating the index for a sample of thirty (30) countries and using the ordinary least squares (OLS) and robust least squares (RLS) methods, the study have analyzed empirically the relationship between the policy mix coherence and the stabilization of the economic activity. The results of the different estimates suggest that in countries where the economic policies regimes have been more synchronous, production have been relatively less volatile. A coherent policy mix seems to promote economic stabilization in line with the economic stabilization theories. This result is an argument in favor of institutional mechanisms of the economic policies coordination.

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