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Evaluation of Exchanges Rate Pass-through to Domestic Prices in Morocco

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Abstract In this article we have evaluated the degree of exchanges rate pass-through to domestic prices (ERPT) during the period spanning from 1979 to 2014, with the aim of exploring the possibility of setting up a more flexible exchange rates system in Morocco. The study showed that ERPT in Morocco is low overall suggesting that the implementation option of a more flexible exchange rate system can be considered in Morocco.

Keywords Exchange rate, Exchange policy, Morocco

1. Introduction

The concept of Exchange-rate pass-through (ERPT) refers to the percentage change in domestic prices resulting from a change in exchange rates for a given country.[1]

This concept has a great theoretical and practical importance for economic policy in a context influenced by external openness. Actually RPT determine the choices made in terms of monetary and exchange rate policies[2], and therefore it has an impact on the adjustment instruments used to address imbalances in the external account of a given country.

The external openness in both commercial and financial dimensions is an inevitable option for any economic development strategy set by developing and emerging countries in a globalized economy. Even if this opening offers many advantages, it brings additional constraints on macroeconomic level, including monetary and exchange policies.

Actually, these constraints have been the focus of theoretical controversies between Mundell and Fleming construction related to the impossible trinity and the "fear of floating", developed by Calvo and Reinhart in 2002.

Indeed, Mundell and Fleming construction consists of the impossible achievement by a country of three objectives simultaneously, namely having a fixed exchange rate, the free movement of capital and the autonomy in conducting monetary policy. The adaptation of this construction to the reality of developing and emerging countries inevitably lead to the choice of a flexible exchange rate policy for countries that wish to maintain the autonomy of monetary policy in a context of capital mobility.

However, the “fear of floating” thesis questions the possibility to keep the autonomy of monetary policy through the introduction of a flexible exchange rate regime since the “passthrough” effect cancels for small and emerging economies, the supposed advantage of flexibility in terms of monetary policy autonomy.

Indeed, the balance of the currency market, which is enabled by the flexibility and its effect on the autonomy of monetary policy is replaced by another type of autonomy loss consisting of the reduction of the link between money and prices, to the extent that the "pass-through" effect tends to be strongest in developing and small countries in general given its positive correlation with the degree of openness and the size of these economies.

Morocco is an economy characterized by a degree of commercial and financial openness relatively high. It is thus at the center of this controversy between Mundell and Fleming construction, and the "fear of floating" for the following reasons:

- a significant capital mobility characterized by a liberal foreign exchange control policy for incoming capital flows of non-residents (full convertibility for non-residents capital account transactions) and a partial opening system for capital account transactions performed by residents (outgoing capital flows);
- a fixed exchange rate system ;

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[1] Peter Rowland, Exchange Rate Pass-through to Domestic Prices: The case of Colombia, Colombian Central Bank, page 6.

[2] Jean-Pierre Allegret, les régimes de change dans les marchés émergents: quelle perspective pour le 21ème siècle, édition Vuibert, 2006, page 170.

- an independent monetary policy at the institutional level, this autonomy will be enhanced by the establishment of an inflation targeting policy.

Indeed, the application of Mundell and Fleming construction to the characteristics of the economy makes the option of setting up a flexible exchange rate system inevitable for managing the external account imbalances in Morocco.

However, taking into account the size of the Moroccan economy and its degree of trade openness, including the import share in GDP suggests a relatively high ERPT in Morocco, hence the necessity to monitor carefully the implementation of a flexible exchange rate system.

The purpose of this paper is to evaluate the degree of ERPT, with the aim to assess the relevance of the current exchange rate system in Morocco and consider the possibilities of its change.

The approach that will be used to assess the degree of ERPT in Morocco is the following:

- presenting beforehand a synthesis of theoretical and empirical studies about the ERPT (literature review);
- establishing a description of the assessment indicators of the ERPT in Morocco;
- finally carrying out an assessment of the degree of ERPT in Morocco through an econometric study.

2. Literature Review

The ERPT has been the subject of several studies that can be divided into two major categories namely; wide studies that cover groups consisting of a large number of countries (with different levels of development) and restricted studies focusing on a specific country or group of countries having relatively close economic development levels.

Thus, among the most important wide studies, we find the study by Goldfajn and Werlang in 2000 that examined 71 developed and emerging countries where the impact on consumer prices is examined using panel estimation methods on data from 1980 to 1998[3]. Another study was developed by "Merou" in 1995 that consisted of 43 empirical studies on industrial products.

Within the category of restricted studies, we find a range of studies, including those conducted in developed countries (Anderlou in 2003, Campa and Goldberg in 2004, Campa and al in 2005, Gagnou and Ihrig in 2004, Hahn in 2003, Mac carthy in 2000) and those focused on emerging countries (Choudri and Hakura in 2006, Frankel and al and 2005 et Mihaljek and al in 2000)[4].

Overall, we can synthesize the results of these studies as follows:

The ERPT to internal prices is usually incomplete; it means that the change in the exchange rate of a given country is not transmitted with the same amplitude to internal prices[5]. The incomplete transmission of exchange rate variations to domestic prices depends on the level of development and the country size[6]. Indeed, ERPT tends to be greater in relatively small low-income economies that are more open with a high share of tradable goods, high import content and limited domestic substitutes[7] (Edwards 2006).

In addition to the size factor, ERPT to internal prices depends within the same category of countries on other microeconomic and macroeconomic factors.

For the microeconomic factors, we can distinguish two categories of factors affecting the ERPT. The first category is related to exchange rates, the second one concerns the nature of the products constituting the foreign trade of a given country.

As regards the factors related to exchange rate, there are three elements impacting effect of exchange rates changes namely, the duration of exchange rate changes, the size of exchange rate changes and the management of exchange rate changes.

For the duration exchange rates changes, the studies conducted by Mueras (2003) on USA, Japan, Germany, France and Italy have shown that ERPT tends to be relatively more complete in the case of persistent shocks of exchange rate. However, the ERPT tends to be less complete in the case of temporary shocks of exchange rate.

The reasons given to explain this assertion lies in the fact that in the case of temporary depreciation of the exchange rate, exporters may be willing to reduce their profit margins to maintain market share in the importing country, given the possibility of hysteresis effect.[8]

Regarding the size of exchange rate changes, studies in this respect, particularly in the USA (Krugman, 1987) have shown that when the magnitude of changes in exchange rates is small, the effect on domestic price is zero because companies prefer to absorb the capital loss due to a depreciation of the exchange rate of the importing country given the costs associated with price changes (menu costs).

As far as the elements related to the sens of exchange rate changes, the literature suggests that the reactivity of exporters to changes in the exchange rate is often asymmetrical depending on the direction of changes in exchange rate (appreciation or depreciation).

In fact, a depreciation of the exchange rate of the destination market, enforce the exporter to reduce its export prices expressed in its currency and to keep the prices of importing country relatively stable which implies a lower

[3] Peter Rowland, Op cit, page 9.

[4] Michel ca' zorzi, Elke Hahn et Marcelo Sanchez, Exchange rate Pass -Through in Emerging Markets, European Central Bank, Working Paper Series, n° 739/March 2007, page 6.

[5] Michel ca' zorzi, Elke Hahn et Marcelo Sanchez,Op cit page 6

[6] Michel ca' zorzi, Elke Hahn et Marcelo Sanchez, Op cit, page 5.

[7] Peter Rowland, Op cit, page9.

[8] Baldwin, Richard E(1988): «Hysteresis Import Prices : The Beachhead Effect », American Economic Review, Vol 78, n°4, pages 773à 785 .

ERPT.

In addition to this, factors related to the nature of the products constituting the foreign trade of a given country, Campa and Goldberg (2005) have shown that manufactured goods have a low ERPT compared to agricultural primary products[9].

The explanation given to the relationship between the nature of the product and the degree of ERPT consists in the fact that manufactured products operate usually in highly competitive markets. In order to keep their market share, exporters are enforced to absorb exchange rate changes.

Conversely, for primary products, the configuration of international and domestic markets is often less competitive. As a result, exporters are less responsive to changes in the value of the exchange rate. Exchange rate changes are thus fully passed on the currency of the importer[10].

In terms of macroeconomic factors, the key element is the monetary stability of a given country which has a negative effect on the level of ERPT (according to studies conducted by Taylor in 2000, Devereux, Engel and storgaard (2003). Indeed, the more monetary conditions and inflation rates are stable, the more the degree of ERPT is low [11].

This correlation has been proven by several econometric studies, including those carried out by Devereux and Engel (2001), Taylor (2000) and Campa & Golherg in 2005 (effective study that concerns 25 OECD countries for the period 75-99).

The results of empirical studies on the ERPT in different countries of the world presented above helped understanding that the degree of transmission of exchange rate changes to domestic prices depends on several parameters including inflation, the size of a country, its degree of openness, the nature of products imported, the duration of exchange rate fluctuations, their magnitude and their direction (appreciation or depreciation).

These analytical elements will be used to identify relevant information required to make assumptions as regards the degree of ERPT in Morocco. Secondly, it will enable us to refine and frame the econometric study of the ERPT evaluation (selection of appropriate evaluation periods of the degree of ERPT in Morocco, analysis of the results emerging from that assessment etc).

3. Assessment of the Level of ERPT Alleged to the Morocco

As indicated above, the level of ERPT depends on the rate of inflation, the rate of opening, the structure of imports and the characteristics of changes in the rate of Exchange (duration, amplitude and direction of variation).

Appreciation in this regard of the degree alleged ERPT requires the analysis of these different factors in the case of the Morocco.

Rate of inflation to the Morocco

Analysis of data relating to the rate of inflation registered in Morocco during the period 1960 a2014 reveals the following key findings:

- the rate of inflation in Morocco remains overall control. Indeed, this rate was on average 2.3% over the period 1994 to 2013 against an average rate of inflation[12] of 6,5% in the comparable to the Moroccan country during that period.
- the rate of inflation is part of a downward trend continues since the beginning of the 1980s, since it moved from an average rate of 9.5% during the period 1972-1982 to 1, 9% in the period 2005 a2013.

Table 1. Inflation rates in Morocco during the period 1960-2013

Period	Average inflation rate
1960-1971	2.5
1972-1982	9.5
1983-1993	6.3
1994-2004	2.7
2005-2013	1.9
1960 - 2013	4.6%

Source: The High Commissioner for the plan, the sources of economic growth in the Morocco.

Degree of openness of the Moroccan economy

Several indicators are used to understand the degree of openness of an economy, depending on the objective sought through the integration of such indicator. In the case of the study of the ERPT, the relevant indicator for assessing the degree of openness is the value of goods imports to GDP.

Indeed, according to the conclusions of different studies about the ERPT as arguments supported to explain such results listed above, the degree of openness means in the sense of the degree of importance products imported[13].

The assessment in respect of the degree of openness of the Moroccan economy will be carried out through the analysis of data on the ratio of imports to GDP. This analysis will be established through:

- observation of the evolution of this ratio during the last years in Morocco;
- the comparison between the average of this ratio to the Morocco during the past ten and five years with that of

[9] Jonas Stulz, Exchange Rate Pass-Through in Switzerland: Evidence from Vector Autoregressions, Swiww National Bank Economic Studiesn n°4, 2007, page 8.

[10] Jonas Stulz, Op cit, page 7

[11]. Michel ca' zorzi, Elke Hahn et Marcelo Sanchez,, Op cit , page 7.

[12] The average of the inflation rates of countries belonging to the category of intermediate income according to the last classification of the World Bank; certain countries were not taken into account because of the not availability of the data (65 countries). The data on inflation rates were extracted from the database of UNCTAD (UNCTADSTAT).

[13] Michel ca' zorzi, Elke Hahn et Marcelo Sanchez,, Op cit, page 7.

countries with exchange rate regime similar to that in Morocco.

These elements are presented in the table below.

Table 2. Rates opening in countries having exchange rate regime similar to that in Morocco

Country	**Average opening rates over the past ten years***	**Average opening rate during the past five years****
Aruba	147%	*104%*
Bahamas	35%	*37%*
Bahrain	48%	*43%*
Barbados	37%	*36%*
Belize	51%	*51%*
Benin	25%	*26%*
Bhutan	48%	*48%*
Burkina Faso	21%	*22%*
Cameroon	20%	*22%*
Tania	46%	*47%*
Central African Republic	13%	*13%*
Comoros	30%	*33%*
Côte d'Ivoire	31%	*32%*
Rep, dem, Congo	46%	*49%*
Denmark	30%	*29%*
Equatorial Guinea	34%	*45%*
Eritrea	38%	*32%*
Fiji	50%	*50%*
Gabon	13%	*12%*
Guinea-Bissau	22%	*24%*
Jordan	63%	*56%*
Kuwait	16%	*15%*
Latvia	50%	*48%*
Lesotho	92%	*88%*
Libya	27%	*30%*
Mali	26%	*27%*
Morocco	37%	*39%*
Namibia	42%	*49%*
Nepal	30%	*33%*
Niger	27%	*32%*
Oman	32%	*33%*
Qatar	20%	*17%*
Samoa	45%	*45%*
Sao Tome and Principe	42%	*43%*
Saudi Arabia	19%	*20%*
Senegal	36%	*37%*
Swaziland	58%	*50%*
Togo	46%	*49%*
Turkmenistan	30%	*39%*
United Arab Emirates	52%	*58%*
Venezuela (Bolivarian Republic of)	15%	*13%*

*Le taux d'ouverture est la moyenne des taux d'ouverture des pays ayant le même régime que celui Maroc pendant 10 dans de 2004 à 2013, calculé sur la base des données de CNUCED selon la formule suivante : importations de biens/PIB

**La moyenne des taux d'ouverture des pays ayant le même régime de change que celui du Maroc pendant 5 ans de 2009 à 2013.

Source: calculated by the author from the UNCTAD data

Observation of the data in the table above, thus pointed out that:

- the ratio of imports to GDP entered an upward trend over the past years. Indeed the average rate of the said ratio rose from 29.16 per cent during the years 2000 to 2004 to 34% during the years 2005-2013, due mainly to the soaring of prices of energy products.
- the comparison between the average of this ratio to the Morocco over the past years with that of countries with a regime of exchange rate similar to that of Morocco, allows that this ratio overall stands at a lower level than the comparison group: 39% to the Morocco versus 38.4% in the comparison group, during the last five years and 37% in the Morocco compared to 41.3% in the Group of comparison over the last ten years.

Indications concerning the Morocco exchange rate variations during the period 1979-2014.

Analysis of monthly data of nominal effective exchange during the period 1979-2014 allows to highlight the following key findings:

- Morocco has experienced during these period six cycles of variation in exchange rates. Exchange rate variation cycles refer to periods corresponding to persistent (depreciation or appreciation) changes in nominal effective exchange rate.
- These cycles of variation of exchange rates include 3 cycles of appreciation, one cycle of depreciation cycle and two a little special cycles: depreciation following a measure of devaluation followed in the first case by a tendency to appreciation and an almost stagnation in the second case.
- the duration of the cycles of change of exchange rate remains very uneven. Indeed, the shortest cycle established 20 months while the longest lasted 165 months.
- the magnitude of changes in exchange rate remains overall relatively low. Indeed on about six cycles there are only two cycles corresponding to a relatively high magnitude.

The table below reported variation in the nominal effective exchange rate cycles to Morocco, their duration, their magnitude and the meaning of those cycles.

Table 3. Synthetic information about the cycles of evolution of the Morocco nominal effective exchange rate

The evolution of the exchange rate cycle period	Cycle time	Magnitude of change in the nominal effective exchange rate *.	The trend of variation in the nominal effective exchange rate
1er cycle: January 1979 to August 1980	20 months	0.20%	The appreciation of the effective exchange of the dirham rate trend.
2nd cycle: September 1980 toMay 1987	81 months	0.42%	The depreciation of the exchange rate trend
3RD cycle: June 1987 to April 1990	35 months	0.52%	The appreciation of the exchange rate trend
4th round: May 1990 to March 1993	34 months	0.32%	Specific cycle: significant decrease (devaluation) followed by a tendency towards appreciation
5th cycle: April 1993 to mars 2001	96 months	0.16%	The appreciation trend
6th cycle April 2001 to late 2014	165 months	0.02%	Specific cycle: significant decrease (devaluation) followed by a quasi - stagnation with a slow and gradual trend appreciation

The elements presented above provide the priori synthetic following in the degree of ERPT initial hypothesis to the Morocco and the methodology for the assessment of the degree of ERPT.

On premise, the degree of ERPT is presumed to be of relatively low or medium to Morocco due to the following arguments:

- the rate of inflation overall is mastery to the Morocco, which allows to formulate the hypothesis that the ERPT is presumed low in Morocco;
- the opening rate of the Moroccan economy apprehended through the criterion of goods imports to GDP Morocco lets consider a relatively low ERPT medium. Indeed, the degree of openness of the Moroccan economy can be considered relatively low compared to countries with similar exchange rate regime to Morocco;

On the methodology for the evaluation of the said degree of ERPT to Morocco, econometric modeling will be performed by adopting a strategy consisting of two main steps:

- a first step that will aim to assess the degree of ERPT without taking into account the lessons from the economic literature. This step will be to:
  . assess the degree of ERPT through an econometric model covering the period from 1979 to 2014;
  . assess the degree of ERPT over different periods chosen according to rupture tests carried out through the DEMETRA software;
- a second step which will aim to assess the degree of ERPT taking into account the lessons from the economic literature. This step is to provide the degree of ERPT through an econometric model established on different periods corresponding to each of them to trends with a uniform meaning: trend to the appreciation or depreciation of the exchange rate. This choice is justified by the fact that, according to the teachings of the economic literature, the ERPT operates effectively during the period corresponding to trends with a uniform meaning.

4. Econometric Study of Assessing the Degree of ERPT in Morocco

As noted above, the econometric study for the evaluation of the degree of ERPT in Morocco will be performed in two main steps:

- a first step will be to:
  . assess the degree of ERPT through an econometric model for the period from 1979 to 2014;
  .assess the degree of ERPT over different time periods chosen according to breaking tests carried through the DEMETRA software;
- a second step will be to assess the degree of ERPT through an econometric model built on different periods for each corresponding to patterns having a uniform direction: tendency to appreciation or depreciation of the exchange rate.

4.1. Assessment Model ERPT Degree during the Period between 1979-2014

- Variables Proposed for modeling the ERPT

The variables used in this model are the Consumer Price Index(CPI) and the nominal effective exchange rate. The data for these two variables are monthly and cover the period spanning from January 1979 to December 2014, are 432 observations.

The choice of these variables is explained by the following reasons:

For the choice of the nominal effective exchange rate, instead of the bilateral exchange rates (dirham / dollar rate and the dirham / euro) to apprehend the exchange rate, this choice corresponds to the methodology commonly used in the various studies conducted As such, the fact that this rate is more relevant to learn about the exchange rate which were carried out external transactions including imports of goods[14].

The choice of this rate avoids the use of bilateral exchange rates which inform only on part of the rates at which were made import of goods operations. According to the data of the balance of settlements of the Foreign Exchange Office, settlements under import transactions carried out in dollars have shown that 50% of all the settlements in respect of goods import.

As for the consumer price index, it is the indicator usually used to understand the level of prices in Morocco.

- Methodology:

The chosen modeling to assess the degree of transmission of exchange rate changes to prices is that of an error correction model. This type of model has the advantage of allowing to specify long-term stable relations while jointly analyzing the short-term dynamics of the variables considered.

The error correction model takes the following form:

$$\Delta y_t = \mu + \sum_{i=1}^{n} \beta_i \Delta y_{t-i} + \sum_{i=0}^{n} y_i \Delta x_{t-i} - \rho[\, y_{t-1} - \alpha\, x_{t-1} - cte \,] + \varepsilon'_t$$

y_t : explained variable
x_t : Explanatory variable
μ : constant
ρ : coefficient of error correction
ε'_t : residual.

This type of model describes a process of adjustment to a long-term equilibrium taking into account other variables involved in the explanation of the dynamic process of the dependent variable. The latter which is the long-term target, is usually following a theoretical underlying relationship to the model. In other words, restraint relationship combines co-integration relationship (long-term target) and a specification of a short-term dynamics as a reminder to the target. ρ represents the rate of convergence or the restoring force to long term equilibrium.

The formalization of the ERPT proceeds according to a multi-step method. The first is to study the order of integration of the series used. This procedure is justified by the fact that we can bond together as variables with similar properties. This phase will also be devoted to the analysis of co-integration between the dependent variable and those explanatory.

As for the second step, it is devoted to the estimation of the model. The tool used to make this body of work is the Eviews software dedicated to this type of investigations.

- Analysis of stationary and co-integration tests

The analysis of the stationary series which is a preliminary to any econometric estimation, is to verify that the order of integration of the time series used in the model is zero.

The methodology is to check the properties of the series with stationary tests Dickey-Fuller and stability.

Stationary tests series of TEN and CPI (shown in Table No. above) show that the CPI is stationary in levels and TEN is stationary in first differences.

This result allows the acceptance of the stationary of the two variables in the first difference.

Table 4. Dickey-Fuller test results

The level of significance is 0.05%

	Calculated value	Tabulated value	Integration order
TEN	-18.25	-3.42	I (1)
IPC	-16.16	-3.42	I (1)

The above table shows that the value calculated (in absolute value) is greater than the tabulated value which means that the two variables are significant.

With regard to the analysis of the co-integration between the consumer price index and the actual exchange rate nominal is important. This procedure to verify the existence of a long term dynamic in the equation for the consumer price index.

The verification of the existence of a co-integration between the consumer price index and the exchange rate will be made through the johansen co-integration test and stability test of Chow.

Indeed, the Johansen co-integration test shows the existence of a relationship of co-integration for the selected equation. The co integration test results are presented below.

Root	Modulus
0.997149	0.997149
0.987342	0.987342
0.218206	0.218206
0.124415	0.124415

As for the stability test, it helped to check the stability (unit roots are less than 1).

Verification of stationary and co-integration tests allowed us to choose the Error Correction model.

Main results from the estimation of the model [33]

The econometric estimation of the ERPT by ECM gave rise to the following results:

$$\Delta\, IPC = 0{,}29\ \Delta IPC\ (-1) - 0{,}32\ \Delta IPC\ (-2) + 0{,}19\ \ -0{,}0022\ [IPC\ (-1) - 1{,}26\ TEN\ (-1) + 49]$$

- Interpretation of results

It is from the above results that all of the usual statistical tests are satisfactory and that the variables have the expected

[14] Adil Hidane, calcul du taux de change effectif nominal et réel du dirham, Minsitère des Finances et de la Privatisation, Direction de la Politique Economique Générale, document de travail n°86, Mars 2003, page 6.

signs. Indeed, the equation shows that short term variation of the index in the consumer price depends only on its previous variation and does not affect by variations in the exchange rate.

On the contrary, in the long term the equation shows the existence of impact of changes in the rate of nominal effective exchange on those of the CPI. Indeed when the value of the nominal exchange rate decrease of 1%, the CPI increased by 0,00277% (1, 26 * 0, 0022) which corresponds to a degree of low transmission.

The 0.0022 coefficient indicates the speed of return to the balance in the event of shocks. Indeed when a shock is observed at the level of the nominal effective exchange rate, the CPI will return to equilibrium with a speed equal to (0, 0022 * 1) per month.

4.2. Model for Assessing the Degree of ERPT during the Seven Sub-periods Spanning 1979-2014

The models chosen for the assessment of the degree of ERPT during the period seven sub-periods spanning 1979-2014 consist of models VAR. The choice of the VAR models is explained by the fact that ECM cannot be used during many sub-periods (05/1985 to 01/1988; 02/1985 to 05/1990; 06/1990 to 10/1992; 11/1992 to05/2001), and this on the basis of the verification of the co-integration test.

The results are presented in the table below:

The results of the VAR models applied in different sub periods indicated in the above table illustrate the following findings:

- the six models are significant ($F_{calculated}$>$_{observed}$ F));
- the most significant variable in six models is TEN(-2);
- the ERPT remains globally low to the Morocco. Indeed, an increase of 1% of the nominal effective exchange rate translates into an average increase of 0.2% of the CPI.
- the relatively low average however hides a significant disparity between periods. It notes in this regard three under periods of low ERPT (sub-periods:01/1979 to 12/1982; 01/1983 to 04/1985-06/2001 to 12/2014) and four periods characterized by a relatively high degree of ERPT (05/1985-01/1988; 02/1988-05/1990-06/1990-10/1992; 11/1992-05/2001).
- the ERPT does not seem to fit into a clear trend. In this respect, it notes three trends:
  - A first downward trend recorded during the period from 01/01/1979 until April 1985 where it weakened from 0.07% to 0.04%;
  - A second important tendency characterized by a level of ERPT relatively high and almost stable one sub-period to another, is the period of 05/1985 to 05/2001;
  - A third tendency which is characterized by the movement to a low level ERPT.

Table 5. Results of the modeling of the ERPT using VAR models covering six sub-periods spanning 1979-2014

Period	Magnitude of the variations of the TEN	Model type	Equation of the model	Comment
[01/1979-12/1982]	-0,12%	VAR	IPC(-1)=1,17IPC(-2)-0,17IPC(-3)-0,07TEN(-2)+0,07TEN(-3)+0,64	In a short term decreased 1% TEN implies an increase of the CPI of 0.07%. Conversely, an appreciation of the exchange rate of 1% were followed by a depreciation of the CPI of 0.007%.
[01/1983-04/1985]	-0,44%	VAR	IPC(-1)=1,25IPC(-2)-0,28IPC(-3)-0,04TEN(-2)+0,026TEN(-3)+3,45	In a short term, a depreciation of the 1% TEN implies an increase of the CPI of 0.04%.
[05/1985-01/1988]	-0,27%	VAR	IPC(-1)=1,23IPC(-2)-0,36IPC(-3)-0,31TEN(-2)+0,203TEN(-3)+14,46	In the short term, a depreciation of the exchange rate of 1% were followed by an increase in the CPI of 0.31%.
[02/1988-05/1990]	0.28%	VAR	IPC(-1)=1,06IPC(-2)-0,44IPC(-3)-0,306TEN(-2)-0, 15TEN(-3) + 7, 49	In the short term, an appreciation of the exchange rate of 1% were followed by a decline of 0.30% CPI.
[06/1990-10/1992]	0.32%	MCE	IPC(-1)=0,69IPC(-2)-0,25IPC(-3)-0,34TEN(-2)+1,12TEN(-3)-31,93	In the short term, an appreciation of the exchange rate of 1% were followed by a decline of 0.34% CPI.
[11/1992-05/2001]	0.11%	VAR	IPC(-1) = 1, 11IPC(-2)-0, 21IPC(-3) - 0, 27TEN(-2)-0, 17TEN(-3)-2, 67	In a Short term, an appreciation of the exchange rate of 1% were followed by a decrease of 0.27% CPI
[06/2001-12/2014]	0.01%	VAR	IPC(-1)=0,54IPC(-2)+0,37IPC(-3)-0,04TEN(-2)+0,05TEN(-3)+7,75	In a Short term, an appreciation of TEN of 1% were followed by an increase in the CPI of 0.04%.

4.3. Models for Assessing the Degree of ERPT Established on Different Periods Corresponding to Trends with a Uniform Meaning

The variables used in this model are the Consumer Price Index (CPI) and the nominal effective exchange rate (TEN). Selected sub-periods are those indicated in the table below.

The model in each period is the VAR. The choice of the VAR models is explained by the fact that ECM is unable to be used years all the sub periods since the variables are not co-integrated on all of the sub-periods. The results of the models and their interpretations are presented in the table below.

The results of the VAR models applied to the different periods corresponding to uniform sense of change of exchange rate trends highlight the following findings:

- models based on different periods, are significant ($F_{calculated} > _{observed}$ F));
- the most relevant variable is the TEN(-2). Indeed, tests for models all emphasize that
- the ERPT remains globally low to the Morocco. Indeed, a variation of the exchange rate of 1% translates to an average increase of 0.09% of the CPI. The results are consistent with the assumptions generated from the application of the findings of the developed economic literature concerning the ERPT in the case of the Morocco presented above, which stipulate that the ERPT stood at low levels when the magnitude of fluctuations in the exchange rate is low and that the exchange rate variation corresponds to an appreciation of the exchange rate.
- the price index for consumption and the nominal effective exchange rates vary in some rounds in the same sense, while in principle, an increase in the exchange rate should lead to a fall in prices while they always tend to increase with a relatively low proportion, this shows that other variables are involved in the determination of the price levels but the exchange rate allows a certain level of weakening the degree of the increase prices.

Table 6. Results of the modeling of the evaluation of the degree of ERPT on the six sub-periods corresponding to trends with a meaning uniform

The evolution of the exchange rate cycle period	**Equation of the model**	**Observation**
1^{er} round: January 1979 to August 1980	IPC(-1) = 0, 79IPC(-2)-0, 25 IPC(-3) + 0.03 TEN(-2) + 0, 29TEN(-3)-21, 15	This cycle is characterized by an appreciation of the exchange rate. Short term, an appreciation of the exchange rate of 1% will result in an increase of the CPI by 0.03%.
2nd round: September 1980-May 1987	IPC(-1) = 1, 21IPC(-2)-0, 17IPC(-3) - 0, 07TEN(-2) + 0, 04TEN(-3) + 4, 33	This cycle is cycle a tendency to depreciation of the exchange rate. Short term, a depreciation of exchange rate of 1% were followed an increase of 0.07% CPI
3RD round: June 1987 to April 1990	IPC(-1) = 1, 13IPC(-2)-0, 46IPC(-3) + 0, 24TEN(-2)-0, 12TEN(-3) + 8, 01	This cycle is characterized by a tendency to the appreciation of the exchange rate. In the short term, an appreciation of the exchange rate of 1% were followed by an increase in the CPI of 0.24%.
4th round: May 1990 to March 1993	IPC(-1) = 1, 03IPC(-2)-0, 19IPC(-3) - 0.16 TEN(-2) + 0, 53TEN(-3)-13, 14	This cycle is characterized by a significant decrease of the exchange rate followed a trend to the appreciation of the exchange rate. In the short term, a depreciation of the exchange rate of 1% were followed by an increase in the CPI of 0.16%,
5th round: April 1993 to March 2001	IPC(-1) = 1, 09IPC(-2)-0, 17IPC(-3) + 0, 04TEN(-2)-0, 028TEN(-3)-3, 87	This cycle is characterized by a tendency to the appreciation of the exchange rate In the short term, an appreciation of exchange rate of 1% were followed by an increase in the price of 0.04%.
6th round April 2001 to the end of 2014	IPC(-1) = 1, 2IPC(-2)-0, 21IPC(-3) - 0, 007TEN(-2)-0, 01TEN(-3) + 2, 74	This cycle is characterized by a significant decrease of the rate of Exchange (devaluation) followed by a slight appreciation of the exchange rate. In the short term, an appreciation of the exchange rate of 1% were followed by a decrease in the CPI of 0.007%.

- the first three rounds manifest a tendency of the ERPT upward.
- the last three models show that the level of the ERPT has weakened in the last 3 rounds (from May 1990 until the end of the year 2014), from 0.16 per cent in 3^{RD} cycle to 0.007% in the last round.

5. Conclusions

The evaluation of exchanges rate pass-through to domestic prices (ERPT) during the period spanning from 1979 to 2014 through the use of various econometric models presented above allows to highlight the following main conclusions:

- the ERPT remains globally low in Morocco what corresponds to the hypothesis of departure emitted on this matter. This result which takes out again various used models confirms the predictions getting free of the application of the main teachings of the economic literature regarding determiners of the effect of the ERPT in the case of Morocco and remains besides coherent with the studies made about the ERPT in the case of Morocco.

Indeed, this literature clarified above, stipulates that the effect of the ERPT is negatively correlated in the degree of opening of the Moroccan economy and in the control (master's degree) of the inflation rate.

Regarding studies made in the case of Morocco, Aziz Ragbi demonstrated, on the basis of two models (SVAR and the BVAR) that, the pass-through in Morocco is incomplete and the transmission of the variations of the exchange rate at the prices (prizes) of exchangeable goods is more important than than posted price of non-tradables. Thus, the pass-through to prices estimated by the SVAR and BVAR tradable goods was 29% and 10% respectively. While the pass-through to the prices of non-tradables is estimated at 1% in both models[15].

- This result must be; however, qualified with regard to the following elements:

The variations of the exchange rate seems dominated by the trends(tendencies) to the appreciation of the exchange rate what does not allow to express himself in a definitive way on the degree of ERPT, with regard to the fact that the degree of ERPT remains small-scale in the case of the appreciation of the exchange rate.

The magnitude of variation of the exchange rate seems globally average (0,27 %) what does not consequently allow to release definitive conclusions about the ERPT, because of the fact that the ERPT seems to appear only on the occasion of variation of exchange rate of strong magnitude.

[15]Aziz Ragbi, ciblage de l'inflation et flexibilisation du régime de change au Maroc, Thèse de doctorat en sciences économiques , Université Mohamed V Rabat –Agdal, Faculté des Sciences Juridiques Economiques et Sociales6Rabat, page 87.

Annex

Validation tests:

1. Normality test:

Period: 1979-2014

Component	Jarque-Bera	df	Prob.
1	29.26544	2	0.0000
2	17340.10	2	0.0000
Joint	17369.37	4	0.0000

Period: 1979-1980

Component	Jarque-Bera	df	Prob.
1	3.102928	2	0.2119
2	2.417710	2	0.2985
Joint	5.520638	4	0.2379

Period:1980-1987

Component	Jarque-Bera	df	Prob.
1	0.804174	2	0.6689
2	16.37950	2	0.0003
Joint	17.18367	4	0.0018

Period: 1987-1990

Component	Jarque-Bera	df	Prob.
1	2.586622	2	0.2744
2	1.616903	2	0.4455
Joint	4.203524	4	0.3792

Period: 1990-1993

Component	Jarque-Bera	df	Prob.
1	1.956595	2	0.3760
2	1.441766	2	0.4863
Joint	3.398361	4	0.4935

Period: 1993-2001

Component	Jarque-Bera	df	Prob.
1	7.182084	2	0.0276
2	1.818427	2	0.4028
Joint	9.000511	4	0.0611

Period: 2001-2014

Component	Jarque-Bera	df	Prob.
1	1.785449	2	0.4095
2	3624.004	2	0.0000
Joint	3625.790	4	0.0000

2. Homoscedasticity test

Period: 1979-2014

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 08/05/15 Time: 13:55

Sample: 1979M01 2014M12

Included observations: 430

Joint test:

Chi-sq	df	Prob.
109.4115	24	0.0000

Period: 1979-1980

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 08/05/15 Time: 09:24

Sample: 1979M01 1980M08

Included observations: 18

Joint test:

Chi-sq	df	Prob.
23.54001	24	0.4881

Period: 1980-1987

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 08/05/15 Time: 09:27

Sample: 1980M09 1987M05

Included observations: 81

Joint test:

Chi-sq	df	Prob.
37.81288	24	0.0362

Period: 1987-1990

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 08/05/15 Time: 09:27

Sample: 1987M06 1990M04

Included observations: 35

Joint test:

Chi-sq	df	Prob.
21.59874	24	0.6032

Period: 1990-1993

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 08/05/15 Time: 09:29

Sample: 1990M05 1993M03

Included observations: 35

Joint test:		
Chi-sq	df	Prob.
38.08698	24	0.0340

Period: 1993-2001

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 08/05/15 Time: 09:30

Sample: 1993M04 2001M03

Included observations: 96

Joint test:		
Chi-sq	df	Prob.
47.78086	24	0.0027

Period: 2001-2014

VAR Residual Heteroskedasticity Tests: No Cross Terms (only levels and squares)

Date: 08/05/15 Time: 09:30

Sample: 2001M04 2014M12

Included observations: 165

Joint test:		
Chi-sq	df	Prob.
129.0804	24	0.0000

3. Variance decomposition:

Period: 1979-2014

Variance Decomposition of IPC:			
Period	S.E.	IPC	TEN
1	0.556171	100.0000	0.000000
2	0.875777	99.96709	0.032907
3	1.122141	99.94182	0.058183
4	1.325641	99.92519	0.074806
5	1.501642	99.91336	0.086644
6	1.658495	99.90406	0.095939
7	1.801128	99.89619	0.103812
8	1.932674	99.88916	0.110839
9	2.055262	99.88266	0.117335
10	2.170412	99.87652	0.123484

Period: 1979-1980

Variance Decomposition of IPC:			
Period	S.E.	IPC	TEN
1	0.200466	100.0000	0.000000
2	0.269046	99.09587	0.904133
3	0.314527	84.33393	15.66607
4	0.381614	60.26807	39.73193
5	0.457337	42.95010	57.04990
6	0.526389	32.78071	67.21929
7	0.584151	26.72795	73.27205
8	0.630426	22.96936	77.03064
9	0.666181	20.57052	79.42948
10	0.692830	19.02096	80.97904

Period: 1980-1987

Variance Decomposition of IPC: Period	S.E.	IPC	TEN
1	0.331655	100.0000	0.000000
2	0.533740	97.91060	2.089400
3	0.699560	94.47508	5.524918
4	0.843451	91.07162	8.928379
5	0.971406	88.23332	11.76668
6	1.086518	86.03551	13.96449
7	1.190874	84.38611	15.61389
8	1.286127	83.15963	16.84037
9	1.373653	82.24434	17.75566
10	1.454597	81.55328	18.44672

Period: 1987-1990

Variance Decomposition of IPC: Period	S.E.	IPC	TEN
1	0.305091	100.0000	0.000000
2	0.481678	95.95768	4.042316
3	0.580276	86.20452	13.79548
4	0.642760	73.82468	26.17532
5	0.695210	63.17402	36.82598
6	0.741736	55.62660	44.37340
7	0.781512	50.21151	49.78849
8	0.817021	45.94200	54.05800
9	0.852037	42.32561	57.67439
10	0.888857	39.10623	60.89377

Period: 1990-1993

Variance Decomposition of IPC: Period	S.E.	IPC	TEN
1	0.727876	100.0000	0.000000
2	1.104517	99.96940	0.030598
3	1.378777	99.97667	0.023329
4	1.594986	99.96957	0.030426
5	1.777334	99.96354	0.036460
6	1.937144	99.95992	0.040084
7	2.080141	99.95760	0.042403
8	2.209745	99.95593	0.044068
9	2.328297	99.95465	0.045351
10	2.437518	99.95363	0.046374

Period: 1993-2001

Variance Decomposition of IPC: Period	S.E.	IPC	TEN
1	0.625384	100.0000	0.000000
2	0.941375	98.34494	1.655061
3	1.154302	95.73350	4.266504
4	1.308200	92.84111	7.158889
5	1.426161	89.89715	10.10285
6	1.520925	86.99352	13.00648
7	1.599878	84.18142	15.81858
8	1.667498	81.49590	18.50410
9	1.726614	78.96100	21.03900
10	1.779077	76.59122	23.40878

Period: 2001-2014

Variance Decomposition of IPC:

Period	S.E.	IPC	TEN
1	0.611329	100.0000	0.000000
2	0.956703	99.99968	0.000315
3	1.220070	99.99485	0.005147
4	1.435651	99.98640	0.013600
5	1.620425	99.97482	0.025180
6	1.783569	99.96112	0.038880
7	1.930491	99.94598	0.054019
8	2.064644	99.92997	0.070027
9	2.188380	99.91352	0.086477
10	2.303386	99.89695	0.103047

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