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Some Preliminary Evidence on the Globalization-Inflation Nexus*

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Abstract

The aim of this paper is to evaluate the impact of globalization, if any, on inflation and the inflation process. We estimate standard Phillips curve equations on a panel of OECD countries over the last 25 years. While recent papers have concluded that globalization has had no significant impact, this paper highlights that trying to capture globalization effects through simple measures of import prices and/or imports to GDP ratios can be misleading. To do so, we try to extend the analysis following two different avenues. We first separate between commodity and non-commodity imports and show that the impact on inflation of commodity import price inflation is qualitatively different from the impact of non-commodity import price inflation, the former depending on the volume of commodity imports while the latter being independent of the volume of non-commodity imports. This first piece of evidence highlights the role of contestability and the insufficiency of trade volume statistics to properly describe the impact of globalization. This leads us to adopt a more systematic approach to capture the contents and not only the volume of trade. Focusing on the role of intra-industry trade, we provide preliminary evidence that this variable can account (i) for the low pass-through of import price to consumer price and (ii) for the flattening of the Phillips curve, i.e. the lower sensitivity of inflation to changes in output gap. We hence conclude that different facets of globalization, especially changes in the nature of goods traded, can be an important channel through which globalization affects the inflation process.

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I. INTRODUCTION

Over the last two decades, a significant fall in inflation has been observed, first in developed countries, and then in emerging economies. Over the same period, there has been a large increase in international trade not only for goods and services but also for financial assets, labour, technology and capital. This phenomenon labelled as globalization did start before the eighties, but it has strongly accelerated during the last two decades following both the fall in international transaction costs (trade and information costs) and the integration of a large number of developing economies to world trade which feature very low labour costs compared to mature economies.

The simultaneity between the modern wave of globalization and the worldwide fall in inflation has suggested that one could be a consequence of the other, the rise in international trade helping bring inflation down. Indeed as notes former chairman A. Greenspan "*Over the past two decades, inflation has fallen notably, virtually worldwide, as has economic volatility. Although a complete understanding of the reasons remains elusive, globalization and innovation would appear essential elements of any paradigm capable of explaining the events of the past ten years.* "

We are hence left with two questions: First, does globalization and more precisely, the rise in international trade in goods in services, bear any responsibility in the dramatic slowdown in trend inflation? Second, do the changes in the short term behaviour of inflation owe anything to the rise in international trade in goods in services? While a definitive answer to each of these two questions is largely beyond the scope of this paper, we focus in this paper on two aspects of the last question - the short term effects of globalization on the inflation level on the one hand and on the inflation cyclical behaviour on the other hand. On each of these two aspects, we provide empirical evidence which suggest that the view that globalization has not had any significant impact on inflation deserves some closer scrutiny.

There is one fundamental theoretical reason why inflation may not have much to do with globalization. It is that inflation reflects changes in the general price level while globalization mainly affects relative prices, i.e. the idiosyncratic component to each good price. For instance if trade openness reduces the price of a given good, it does so relatively to the price

of other goods and services which is precisely what inflation is not about. This argument has been made forcefully by L. Ball (2006). On the basis of the dichotomy between relative prices and the general price level, L. Ball argues that globalization cannot affect trend inflation which is anything but a monetary phenomenon under the control of the money issuer, i.e. the central bank.

However, there are a number of important limits to this argument. First, it does obviously not rule out the possibility that globalization affects the cyclical variations in inflation, or more generally the cyclical properties of the inflation process. At least, the mechanism through which that may happen is not straightforward[3]. Second, this argument directly relies on the dichotomy between changes in relative prices and changes in the general price level. While this dichotomy is totally relevant in the long run, it does not apply in the short run. Hence globalization can affect in the short run the inflation level. Finally it is possible that this dichotomy does not apply in the long run either. Considering a menu cost model for instance, if globalization raises the frequency and/or the magnitude of (relative) price updates, this will induce the central bank to adopt a lower inflation rate[4], inflation being essentially a second best mechanism which helps dampen the real effects of nominal rigidity. Alternatively if the central bank suffers a credibility problem, then globalization can have an impact on inflation through its mitigating effect on the central bank lack of credibility.

Using a simple time inconsistency model this last argument has been developed by K. Rogoff (2004). When the central bank faces the possibility to raise output through inflation at the cost of moving from the rule based to the discretionary equilibrium, the central bank incentives to raise inflation are lower when the difference between actual and optimal output is lower. If the globalization induced reduction in the rents firms can actually seek tends to reduce the difference between first and second best output levels, then the central bank will less frequently resort to the discretionary equilibrium of high inflation. As a consequence trend inflation will be lower. In some sense, globalization reinforces monetary policy credibility and acts as a commitment device when the central bank announces a low inflation objective. Globalization could hence have shifted the global economy into a low inflation environment.

[3] If globalization modifies price rigidity - for instance the frequency of price changes-, then this can likely modify the relationship between inflation and the output gap.

[4] The dichotomy between nominal and real price changes does essentially apply in neo-keynesian frameworks with sticky prices "à la Calvo", i.e. where firms update their prices following a Poisson process with exogenous parameters. It fails to apply as soon as price stickiness is endogenous to monetary policy.

While this story is appealing and seems relevant especially to account for the fall of inflation in countries where central banks used to suffer from a credibility problem (in particular emerging market economies with high inflation records), it does behave quite poorly in the face of developments in mature economies especially as regards its implications for the slope of the Phillips curve. In theory, lower rents and lower mark-ups should tend to reduce the gains to raise inflation and hence raise the slope of the Phillips curve –a larger change in inflation is needed to increase output in a given amount-. But there is overwhelming evidence that the slope of the Phillips curve has if anything decreased not increased - a larger increase in output can in principle now follow a given increase in inflation-. This counter-factual prediction has put into question the role of globalization in the reduction in trend inflation in developed economies.

Borio and Filardo (2007) have recently tackled the question claiming that Phillips curve flattening itself can be regarded as a consequence of globalization. Not withstanding the fact that stronger competition should in theory tend to steepen the inflation output trade-off, they stress that globalization could well reduce the sensitivity of inflation to domestic output essentially because net imports can act as a buffer to balance domestic demand and supply, this helping curb inflationary pressures. They successfully test this idea. More precisely they show that a measure of foreign output gap -a weighted average of trade partner output gaps has a significant explanatory power in the cyclical variations of inflation. Moreover they show that the sensitivity of inflation to the measure of foreign output gap has increased over time while the sensitivity to domestic output gap has on the contrary been reduced. Yet, a debate has grown around the empirical relevance of measures of foreign output gap for domestic inflation. Ihrig et al. (2006) has recently shown that the effect of foreign output gap on domestic inflation is not always robust to alternative empirical specifications especially when inflation persistence is accounted for.

Hence, the empirical debate on globalization – inflation nexus is still largely unsettled, and the validity of the view that globalization has significantly affected inflation largely depends upon which factor of globalization and which facet of inflation is being considered. As far as theory is concerned, things are pretty different.

Using the utility based approach to monetary policy, Razin and Loungani (2005) show that central banks tend to focus on maintaining low inflation more heavily, the more open the

economy is. The idea is that trade and financial openness tend to reduce the inefficiency of fluctuations in the output gap relative to the inefficiency of fluctuations in the inflation rate. Addressing a different question, Woodford (2007) shows that the fear that globalization could harm the ability of central banks to control domestic inflation is largely overdone as long as the central bank chooses the right interest rate rule and in particular to react to changes in the output gap of foreign trading partners.

Almost all theoretical approaches to the globalization-inflation debate however suffer the discrepancy between the (recent) trade literature which focuses on the microeconomic adjustment to trade (within firms or labour markets with a particular emphasis on firm heterogeneity) and the new Keynesian framework, the now standard approach to monetary policy where microeconomic mechanisms are quite primitive (a good example being the relationship between trade and market power). It is now a stylized fact that openness to trade is pro-competitive and tends to reduce firm mark-ups (cf. Boulhol (2005)). However the standard approach to monetary policy based on CES utility functions implies no particular relationship between openness to trade and mark-ups. In fact there are largely orthogonal to each other. This discrepancy between some basic stylized facts and the models' predictions undoubtedly calls for precaution in asserting that globalization has or has not affected inflation on the basis of these models.

Our paper aims at contributing to the debate over the globalization inflation nexus. Lacking a proper theoretical framework to assess the relevant mechanism and determine the magnitude of these effects, we favour an empirical approach with the aim to determine stylized facts on the question of the impact of globalization on inflation. The results the paper brings are broadly divided into two main parts. Based on a standard Phillips curve equation –following a number of previous studies of the empirical literature-, we first assess the effect of globalization on inflation through the traditional channel of import prices. We provide three simple results.

First, the effect of import price inflation on consumer price index (CPI) inflation is low, around 10-15%. This means that a 1pp increase in import price inflation produces an instantaneous 0.1-0.15pp increase in CPI inflation. These figures are roughly in line with the magnitudes found in the literature. Hence if globalization affects CPI inflation exclusively through import price inflation, given CPI inflation estimated persistence, a 1pp permanent

decrease in CPI inflation requires a 3-5pp permanent decrease in import price inflation. Clearly no country in our sample has experienced such a large shock while the permanent decrease in inflation has been largely above 1pp. Is this evidence that globalization has had very tiny effects on inflation? Yes as long as, as stated above, globalization impacts inflation exclusively through import price inflation. No if other channels need to be considered. Among other channels that need to be considered lies the volume of imports: it is likely that the effect of import price inflation depend on the import penetration. To put it briefly, it is reasonable to believe that CPI inflation in an almost closed economy is less sensitive to import price inflation than in a fully open economy.

The second result we come up with is the paradox that the sensitivity of CPI inflation to import price inflation does not significantly depend on the volume of imports (as a share of GDP). Hence we are left with the puzzle that import price inflation affects CPI inflation similarly whatever the volume of imports to GDP. This leads us to investigate the source of this unexpected result. To do so we decompose imports between commodity and non commodity imports and we test for each of these two items whether they affect CPI inflation independently from or conditionally on the volume of the relevant imports.

This investigation brings our third result: the impact of import price inflation does depend on the volume of imports but only for commodity imports. For non commodity imports, the impact of import price inflation on CPI inflation is the same whatever the volume of non commodity imports. An interpretation to this result is that the presence or the lack of contestability is fundamental to assess the impact of globalization on inflation. Non-commodity imports are essentially manufactured goods imports for which contestability exists. Hence domestic producers modify their prices according to the price of imports or according to the international price whatever the effective volume of imports because the threat of possible imports triggered by arbitrage opportunities stemming from price gaps is credible. Hence globalization effects on inflation could materialize even in the absence of any trade flow. However, this is not true for commodity goods. These goods have no direct substitute (think of energy or agricultural goods for example). Hence the effect of commodity import price inflation on CPI inflation is proportional to the volume of commodity imports.

The second part of the paper is devoted to systematize the intuition that the key element to assess the impact of globalization on inflation is the extent to which goods imported can be

similar or used as substitutes to goods produced domestically. To capture similarity between goods imported and goods produced domestically in a given market we consider the Grubel-Lloyd index of intra-industry trade[5]. This index basically compares the volume of net trade (absolute difference between imports and exports) to the volume of total trade (sum of imports and exports) within a given sector. The larger the volume of net trade, the lower the similarity between imports and domestic output and hence the weaker the threat that imports can easily replace domestic output. Intuitively with large net exports, imports do not constitute a significant threat to domestic producers. Conversely, large net imports arise when domestic output is unable to meet domestic demand for some goods. There is then no substitutability between domestic output and imports. However it is important to note that the Grubel-Lloyd index refers to exports rather than domestic output. While it is possible to assume that exports are a relevant approximation of domestic output, we also consider as an alternative indicator the import penetration ratio which compares the volume of imports to total demand at the industry level[6]. We use these indexes to show two different properties.

First we go on with the examination of import price inflation pass-through to CPI inflation and check whether intra-industry trade index could be a significant determinant of it. More precisely we run a horse race with different variables, including the volume of imports, the degree of labour market rigidity or the degree of monetary policy credibility. We show that the index for intra-industry trade is a significant determinant of import price inflation pass-through to CPI inflation. This confirms the view that the impact of globalization on inflation does not depend on the actual volume of trade but on the potential volume of trade more accurately captured by the Grubel-Lloyd index or the import penetration ratio. Moreover higher intra-industry trade is always found to reduce the pass-through of import price inflation to CPI inflation. This is entirely consistent with the view that higher substitutability between domestic output and imports tends to reduce the impact of import price inflation. For example a positive shock on import price inflation is less inflationary as domestic demand can more easily substitute imports with domestic output. Openness of mature economies to low cost countries is also a good illustration of the impact of intra-industry trade on import price inflation pass-through. The former tends to reduce the index of intra-industry trade because it triggers specialization across countries. So CPI inflation in mature economies is more sensitive to import price inflation because more goods –especially labour intensive goods

[5] Grubel and Lloyd (1975, p. 86) define intra-industry trade as "trade in differentiated products which are close substitutes".

such as textiles, shoes or toys- are consumed but not produced anymore domestically. Hence an interesting paradox arises: if globalization tends to raise the extent of intra-industry trade, then the low pass-through of import price inflation to CPI inflation which could be considered at first glance as illustrating that globalization has (had) no impact on inflation is indeed due to a particular feature of globalization, i.e. the relative importance (increase) of intra-industry trade in total trade of mature economies.

Second we study whether the intra-industry trade index can be a determinant of the slope of the Phillips curve. The intuition is the following: if the goods domestically produced are similar to the goods imported then domestic inflation should be less sensitive to changes in the domestic output gap. On the contrary, there is no particular reason why the volume of imports should affect the sensitivity of inflation to the output gap since imports can typically be goods for which there is no particular domestic substitute (think of energy for instance). We confirm both of these intuitive predictions and show that the volume of trade has no significant explanatory power on the slope of the Phillips curve while the intra-industry trade index does account for the reduction in the sensitivity of domestic CPI inflation to the domestic output gap[7]. This result systematizes the intuition of Borio and Filardo (2007): imports can act as a buffer in the domestic supply and demand equilibrium, hence reducing the sensitivity of domestic inflation to domestic output. However for this property to hold, we need that imports can easily substitute domestic output. This is what we capture through the intra-industry trade measure. Besides avoiding the caveats of foreign output gap data building, intra-industry trade hence provides a simple measure of how globalization has contributed to Phillips curve flattening. Finally, we show that our results are robust to the inclusion of a number of variables such as monetary policy credibility, labour market rigidity, financial integration, etc… and also to different measures of intra-industry trade.

[6] Tables show that the results are qualitatively the same whatever the indicator used be it Grubel-Lloyd or import penetration.

[7] Following our interpretation, openness to low cost countries should trigger a steeper Phillips curve while on the basis of a simple intuition, the induced specialization creates or increases the wedge between the goods produced domestically and the goods consumed. Hence this would rather reduce the sensitivity of CPI inflation to the domestic output. Flatter Phillips curve would then be associated with lower not higher intra-industry trade as we claim here. This simple intuition however misses two important effects. Consider the example of a mature economy where the domestic textile industry disappears. Then the pricing power of the average producer in the mature economy increases because the most constrained producers in terms of pricing power –those of the domestic textile industry- have disappeared due to low cost countries competition. Second the pricing power of capital intensive industries tends to increase due to international specialization and hence reinforces the positive effect on the pricing power of the average domestic producer. As a result, openness to low cost countries tends at the same time to reduce the index for intra-industry trade in the mature economy but to raise the average pricing power of domestic producers. This implies in particular that markups in the mature economy become more procyclical when trade is more inter-industry. Hence with a lower intra-industry trade index, the Phillips curve becomes steeper which is then consistent with our empirical results.

The rest of the paper is organized as follows. The next section lays down the econometric methodology and presents the data used in estimations. Import price inflation pass-through is investigated in section 3. The role of intra-industry trade is introduced and studied in section 4. Finally conclusions are drawn in section 5.

II. DATA AND ECONOMETRIC METHODOLOGY.

The basic specification we build on our empirical investigation is a standard Phillips curve equation which relates contemporaneous CPI inflation π_t to lagged CPI inflation π_{t-1} and contemporaneous output gap y_t

$$\pi_t = \alpha + \beta_0 \pi_{t-1} + \beta_1 y_t + \varepsilon_t \quad (1)$$

the time indicator being t and ε being an error term. Because the dataset we use is a panel of countries, the empirical specification we estimate is slightly modified to allow for fixed effects, i.e. cross country differences in the unconditional CPI inflation rate:

$$\pi_{it} = \alpha_i + \beta_0 \pi_{it-1} + \beta_1 y_{it} + \varepsilon_{it} \quad (2)$$

π_{it} being CPI inflation in country i at time t and yit being the output gap in country i at time t. Estimating this equation with simple OLS or WITHIN estimators is known to be inconsistent due to the presence of both fixed effects and the lagged dependent variable as a right hand side variable. A standard method to deal with this problem consists first in differentiating the last equation as to get rid of fixed effects α_i

$$\pi_{it} - \pi_{it-1} = \beta_0 (\pi_{it-1} - \pi_{it-2}) + \beta_1 (y_{it} - y_{it-1}) + (\varepsilon_{it} - \varepsilon_{it-1}) \quad (3)$$

Second the differentiated right hand side variables can be instrumented with two and three period lagged levels of the right hand side variables of equation (2). Validity of instruments can finally be tested with the standard Sargan test of validity of overidentifiying restrictions.

A second method that can be used to deal with the specific problem of dynamic panel models with fixed effects consists is using the generalized method of moments (GMM) methodology developed by Arellano and Bond. GMM takes advantage of the fact that lagged variables can

provide a large number of instruments by building an optimal instrument matrix which can considerably raise estimation efficiency. However it should be noted that that the Arrellano and Bond methodology is designed for panel where the cross-section dimension is much larger than the time dimension (small T, large N) which is not necessarily the case in the panel we consider.

The methodology we use consists in using equation (3) as a benchmark. To capture the effect of globalization on inflation we use a number of variables that we include as right hand side variables following two different specifications. One consists simply in adding these variables on their own to capture whether these variables do influence the level of inflation. For example considering that the variable x is import price inflation equation (4) can tell whether and how much does import price inflation affect CPI inflation.

$$\Delta\pi_{it} = \beta_0 \Delta\pi_{it-1} + \beta_1 \Delta y_{it} + \beta_2 \Delta x_{it} + \Delta\varepsilon_{it} \qquad (4)$$

The second possibility consists in testing whether the variables representing globalization influence CPI inflation not through its level but through its sensitivity to standard inflation determinants such as the output gap for instance. To test this possibility we build a linear interaction variable which assumes that the effect on CPI inflation of a change in say the output gap will be linear in the globalization variable we consider.

$$\Delta\pi_{it} = \beta_0 \Delta\pi_{it-1} + \beta_1 \Delta y_{it} + \beta_2 \Delta y_{it} x_{it} + \Delta\varepsilon_{it} \qquad (5)$$

For instance if we test the impact of the import to GDP ratio on the sensitivity of inflation to the output gap, then we estimate equation (5) where x is the import to GDP ratio and other variables are the same as previously.

We identify three limits to the empirical exercise we carry out.

First, we need to deal with the traditional problem of the Lucas critique. The results that come out of the empirical estimations can be regarded as the "true underlying effect" on CPI inflation of the variables we consider. These results can also be regarded as a mix between the "true underlying effect" and changes in economic policies that follow the shocks on this variable. Take for instance, import price inflation. If as will be detailed below, the effect of import price inflation on CPI inflation is found to be relatively small, this could be that the CPI inflation is really relatively insensitive to import price inflation, but it can also be the case

that domestic economic policies display dampening effects of import price inflation. For example fiscal authorities can decide to cut taxes when oil prices go up as to reduce the negative effects of higher import price inflation. However this certainly participates in dampening the effect of the import price inflation on CPI inflation. Similarly, if monetary policy contributes to maintain a stable inflation rate by reducing interest rates when inflation is below objective and raising them when inflation is above objective, then it ends up being clear that estimated effects are bound to be rather small.

Is this identification problem a concern for our study? We think no for two reasons. First, the above examples show that identification is a relevant concern as long as we observe rather small effects, the question being, are these real small effects or are these large effects but dampened through economic policy changes? Hence when it is claimed that globalization has had no impact on inflation, this may be due to the fact that we only observe the sum of globalization and economic policy impacts on inflation. However, the point of this paper is precisely to claim that there is some evidence that globalization has had some impact on inflation. Hence, we provide evidence that globalization does affect inflation in spite of the theoretical possibility that the effects we try to capture are in fact much larger which reinforces our argument. The second reason why identification is less a concern for our study than in the general case is that we focus much less on level than on interaction effects for while the Lucas critique is more relevant for the former than the latter.

The second limit to our empirical exercise is specific to the estimation of interaction effects. In equation (5), the term β2 can be interpreted as the marginal effect of the interaction term yx if and only if the terms the variables y and x are also present as right hand side variables on their own. Hence to interpret properly β2 as an interaction effect, we need to estimate the following equation

$$\Delta\pi_{it} = \beta_0 \Delta\pi_{it-1} + \beta_1 \Delta y_{it} + \beta_2 \Delta y_{it} x_{it} + \beta_3 \Delta x_{it} + \Delta\varepsilon_{it} \qquad (6)$$

Otherwise β2 can represent an interaction effect but can also represent the effect of the x variable on its own. In the example given above where y is the output gap and x is the import to GDP ratio, a significant coefficient β2 could either be that openness to imports significantly affects the sensitivity of CPI inflation to the output gap but it could also represent the direct impact of openness to imports on CPI inflation. There is however one reason why we prefer equation (5) to equation (6). It is that we want to stick to the Phillips

curve framework in which right hand side variables that affect inflation are all nominal except the output gap. Although it may be argued that it is always possible to run a regression whatever its consistency, introducing "real" right hand side variables is contradictory with the underlying framework our estimations are based on. It must be the case that the estimation we carry out be grounded on a formal model which would link inflation to some real variable such as openness to trade or competition for instance. This has been carried out in previous studies (See Romer 1993, Lane 1997 or Temple 1999). However these studies are concerned with the determinants of long run inflation not with the cyclical properties of inflation as we are.

Finally a third concern deals with the dynamic structure of the empirical specification we use. A large body of the recent literature on Phillips curves has stressed the importance of forward-lookingness in the inflation process so that it is now common to introduce expected inflation as a right hand side variable. While we do acknowledge that this can be a limit to the argument we want to build, we prefer a simple specification where inflation depends on its lag first because the robustness of dynamic models with forward looking variables can be quite low, this implying that our results could also lack robustness. Second we try to follow the literature on the globalization inflation debate as to provide evidence that can easily be compared and contrasted with those of other studies. Finally while every econometric refinement in the inflation process is in theory welcome, it is important to keep in mind that the marginal complexity should be trade-off against the marginal gain the refinement brings. In the case of introducing forward lookingness, it is not clear how large is the latter compared to the former as far as the issues we are interested in are concerned.

We focus our study on the industrialized OECD countries, i.e. we abstract from Central and Eastern European countries (Hungary, Poland, Slovakia, and the Check Republic), and emerging markets (Mexico, Turkey and South Korea). We end up with a panel of twenty one countries. The largest time period we consider is 1980-2005. Because the study makes extensive use of lagged variables, and because all data is not always available for the whole 1980-2005 period, the effective time period for estimation can be much shorter. We consider annual or alternatively quarterly data. We however only present results obtained with annual data because results with quarterly data are qualitatively identical and quantitatively close. Moreover some data (especially indicators based on sector level data) do not exist at higher than annual frequency.

Data used come from OECD and CHELEM datasets. The hard macroeconomic data (CPI, GDP deflator, output gap, imports, total, commodity and non-commodity import prices, unit labour cost) come from the Economic Outlook dataset. Data on the composition of imports comes from the OECD Monthly Trade Statistics database which contains a desegregation of imports by country of origin or by good following the standard international trade classification which essentially is a one digit desegregation of import flows. Data on intra-industry trade and import penetration is computed on the basis of data for imports and exports measured at the two-digit industrial level for the manufacturing sector following the international standard industrial classification. The OECD STAN (Structural Analysis Indicators) database does provide this type of information. We also use the CHELEM dataset which provides data on trade flows for 70 different categories of goods to compute the intra-industry trade index.

III. INVESTIGATING IMPORT PRICE EFFECTS

We first estimate the benchmark equation (1) which relates CPI inflation to lagged CPI inflation and output gap[8]. Table 1 provides the results of this estimation. The first column shows the simple WITHIN estimates which provide unexpected coefficients with a negative persistence in inflation and no significant cyclical effects. In the following columns, we try to solve the endogeneity issue using instrumental variables estimation.

Table 1

Standard Phillips Curve Estimations

Estimations	1	2	3	4	5	6	7
Dependent variable: **Annual CPI Inflation**	OLS	IV	IV	IV	IV	IV	IV
Lagged CPI Inflation	-0.189***	0.463***	0.389***	0.686***	0.693***	0.524***	0.708***
	(4.77)	(4.72)	(4.42)	(4.61)	(4.74)	(4.52)	(4.87)
Output Gap	-0.043	0.239*	0.252**	0.345**	0.375**	0.295**	0.372**
	(0.75)	(1.82)	(2.37)	(2.23)	(2.51)	(2.56)	(2.47)
Sargan Test *(p. value)*	-	0.003	0.021	0.037	0.111	0.134	0.184
Observations	559	514	514	514	514	514	514
Number of cross sections	23	23	23	23	23	23	23

Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. All estimations include country dummies not reported. All estimations include a constant term. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Hausman test carried out for IV estimations always reject the null that OLS estimation is consistent. Cf. appendix for instrument list for IV estimations.

[8] We have also estimated a similar specification with time dummies on the right hand side and GDP deflator in place of CPI to check whether our results can be extended in these cases. No estimation has proven to be contradictory with the results presented. Results can be found in appendix "Robustness Tests".

The results of these estimations are more in line with the common wisdom on Phillips curve parameters, i.e. positive and relatively large persistence in inflation on the one hand and positive but relatively low correlation with cyclical variations in output especially when compared with predictions of models with nominal rigidity on the other hand. Estimations in columns 5-7, for which the null of instruments validity cannot be rejected provide relatively close results: inflation persistence between 0.5 and 0.7 and sensitivity to output gap between 0.3 and 0.37.

We next introduce import price inflation as a possible determinant of CPI inflation. As previously, we first provide the WITHIN estimates and then correct for the endogeneity problem in the next columns. The striking point in these estimates is the relative insensitivity of the effect of import price inflation to CPI inflation to the estimation method and to the set of instruments included. The estimated effect of import price inflation on CPI inflation ranges from 0.11 to 0.15, these figures being consistent with the estimates found in the literature (from 0.1 and 0.2). Moreover the magnitude of the import price inflation effect is relatively insensitive to the introduction time dummies or control variables such as monetary policy credibility[9].

Table 2

Phillips Curve with import price inflation

Estimations	1	2	3	4	5	6	7
Dependent variable: **Annual CPI Inflation**	OLS	IV	IV	IV	IV	IV	IV
Lagged CPI inflation	-0.082**	0.413***	0.367***	0.588***	0.625***	0.530***	0.516***
	(2.16)	(5.06)	(4.88)	(4.36)	(4.62)	(5.03)	(4.92)
Output Gap	-0.061	0.261**	0.177*	0.333**	0.333**	0.229**	0.224**
	(1.15)	(2.32)	(1.86)	(2.58)	(2.51)	(2.16)	(2.13)
Import price inflation	0.145***	0.199***	0.121***	0.140**	0.122**	0.113***	0.117***
	(10.00)	(3.95)	(4.63)	(2.07)	(1.79)	(3.94)	(4.10)
Sargan Test *(p. value)*	-	0.016	0.067	0.187	0.206	0.447	0.487
Observations	559	514	514	514	514	514	514
Number of cross sections	23	23	23	23	23	23	23

Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. All estimations include country dummies not reported. All estimations include a constant term. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Hausman test carried out for IV estimations always reject the null that OLS estimation is consistent. Cf. appendix for instrument list for IV estimations.

Hence a 1 pp increase in import price inflation produces an instantaneous rise in CPI inflation between 0.11 and 0.15 pp. Moreover given the estimated inflation persistence, the effect of a transitory shock on import price inflation is approximately twice smaller each following year.

[9] Cf. estimation in appendix, Table 1 "Phillips Curve with import price inflation and monetary policy credibility"

For instance the effect on CPI inflation of a 1 pp increase in import price inflation is about one hundred times smaller after three years. Estimations on quarterly data essentially provide similar magnitudes (both for import price inflation effect and inflation persistence) although, the frequency being higher, the effects disappear much more rapidly. Hence if globalization affects CPI inflation exclusively through import price inflation, given CPI inflation estimated persistence, a 1pp permanent decrease in CPI inflation requires a permanent decrease in import price inflation above 4pp. No country in our sample shows so large a ratio of import price decline to CPI inflation decline[10].

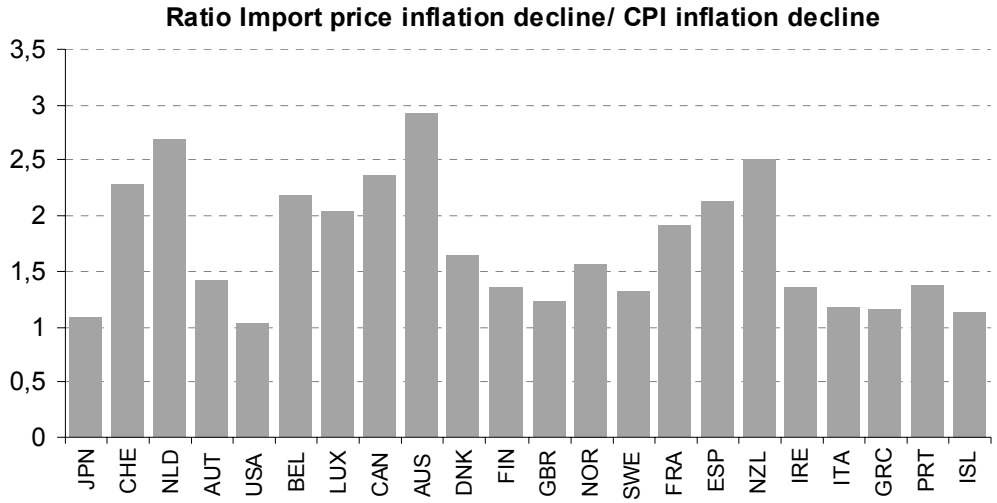

Chart 1

CPI inflation decline is the difference between the average CPI inflation rate over 1980-1985 and the average CPI inflation rate over 2000-2005. Import price inflation decline is the difference between the average import price inflation rate over 1980-1985 and the average import price inflation rate over 2000-2005

Are these small effects of import price inflation on CPI inflation evidence that globalization has had very tiny effects on inflation? Yes as long as globalization impacts inflation exclusively through import price inflation. No if other channels need to be considered. Among other channels that need to be considered lies the volume of imports: it is likely that the effect of import price inflation depend on the import penetration. To put it briefly, it is reasonable to believe that CPI inflation in an almost closed economy is less sensitive to

[10] This exercise is based on the implicit assumption that CPI inflation can move in the long run with import price inflation which could appear as contradictory with the widespread view that inflation is in the long run under the control of the monetary authority. There are three reasons our exercise is not necessarily contradictory with this view. First the long run optimal inflation rate the central bank sets may be related to the rate of import price inflation. Second in the approach we consider here, changes in import prince inflation are exogenous while in the long run, they are probably endogenous as monetary policy also affects the nominal exchange rate. Finally even if optimal long run inflation is independent of import price inflation, it is likely that the disinflation effect of imports creates an opportunity for the central bank to move from a high to a low inflation steady state at a social lower cost. Hence that import price inflation has a long run effect on CPI inflation should not be regarded as contradictory with the view that long run inflation is exclusively determined by the central bank.

import price inflation than in a fully open economy. Hence it could be that the small effect of import price inflation on CPI inflation simply reflects that countries in our sample are relatively closed to imports in the sense that trade represents a relatively small share of their GDP. This possibility is examined in the next regressions.

Table 3

Phillips Curve with interaction between import price inflation and imports to GDP ratio

Estimations	1	2	3	4	5	6	7
Dependent variable: **Annual CPI Inflation**	OLS	IV	IV	IV	IV	IV	IV
Lagged CPI inflation	-0.088**	0.478***	0.746***	0.708***	0.586***	0.591***	0.726***
	(2.24)	(5.87)	(5.27)	(5.07)	(5.64)	(5.67)	(5.14)
Output Gap	-0.053	0.354***	0.481***	0.487***	0.290***	0.302***	0.513***
	(0.99)	(2.93)	(3.16)	(3.26)	(2.60)	(2.71)	(3.42)
Import price inflation * Imports to GDP	0.445***	0.604***	0.401**	0.381**	0.331***	0.324***	0.358**
	(10.72)	(5.30)	(2.55)	(2.47)	(4.28)	(4.19)	(2.34)
Sargan Test *(p. value)*	-	0.000	0.003	0.036	0.095	0.114	0.137
Observations	537	492	492	492	492	492	492
Number of cross sections	23	23	23	23	23	23	23

Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. Imports to GDP is the ratio of total imports (goods and sevices) to GDP. Import price inflation * Imports to GDP is the product of Import price inflation and Imports to GDP. All estimations include country dummies not reported. All estimations include a constant term. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Hausman test carried out for IV estimations always reject the null that OLS estimation is consistent. Cf. appendix for instrument list for IV estimations.

When CPI inflation is regressed on the interaction of imports to GDP and import price inflation, the estimated effect is expected to be around one if the ratio of imports to GDP is a good approximation of the total share of imports in the typical consumption basket. According to such estimation, a rise in import price inflation would hit CPI inflation proportionally to the imports to GDP ratio of the economy.

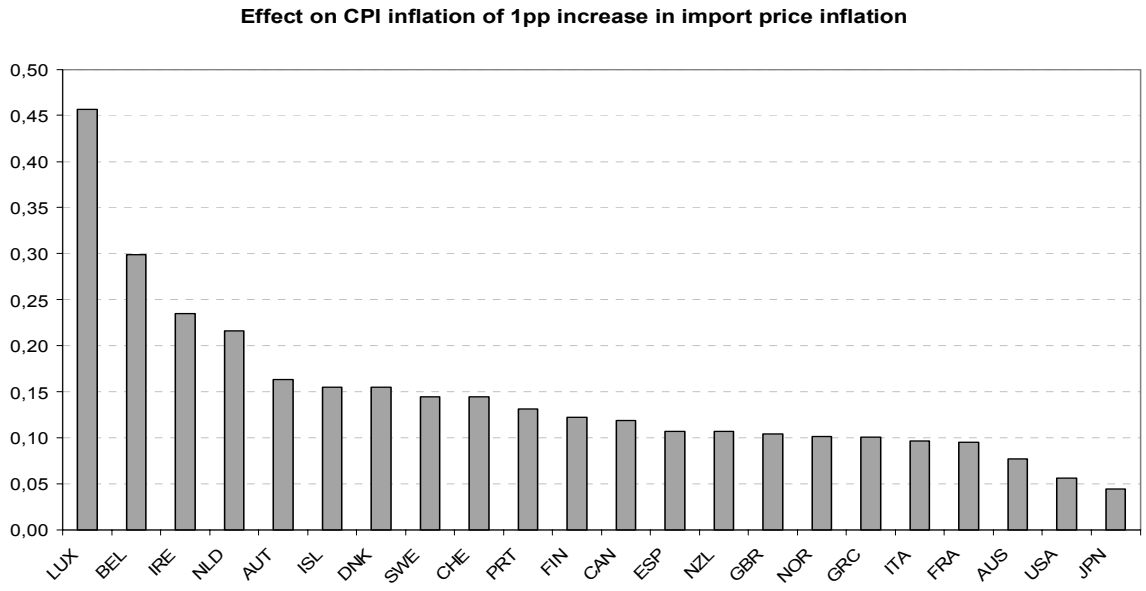

Chart 2

Estimations however show that the effect is roughly one third of what would be expected on the basis of a simple calculation. Hence assuming an import to GDP ratio around 30%, a positive 1pp shock to import price inflation raises contemporaneous CPI inflation around 0.10 pp.

There are possibly two reasons why the estimated coefficient of the imports to GDP import price inflation is so low. One is that the import to GDP ratio is much higher than the actual share of imports in the typical consumption basket that is used to determine the CPI. Another possible explanation is that only some type of shocks on import price inflation -negative shocks for instance- are transmitted to CPI inflation while others –inflationary shocks possibly- are dampened. While this hypothesis is difficult to test with macro data and left for further work, some preliminary evidence at the sector level shows that there is indeed some asymmetry in the transmission of shocks[11]. What we can however easily test at the macro level whether the impact of import price inflation on CPI inflation depends or not on the volume of imports. Intuitively that should be the case.

Table 4

Deciding between import price inflation and the interaction with imports to GDP

Estimations	1	2	3	4	5	6	7
Dependent variable: **Annual CPI Inflation**	OLS	IV	IV	IV	IV	IV	IV
Lagged CPI inflation	-0.078**	0.475***	0.730***	0.473***	0.545***	0.684***	0.693***
	(1.98)	(5.93)	(5.18)	(5.90)	(4.05)	(8.48)	(8.57)
Output Gap	-0.052	0.369***	0.478***	0.369***	0.237	0.496**	0.505**
	(0.97)	(3.08)	(3.24)	(3.09)	(4.52)	(2.22)	(2.21)
Import price inflation * Imports to GDP	0.295***	0.143	0.169	0.170	-0.260	-0.008	0.038
	(3.38)	(0.57)	(0.57)	(0.67)	(1.25)	(0.04)	(0.22)
Import price inflation	0.061*	0.192*	0.099	0.186*	0.210***	0.175**	0.158**
	(1.94)	(1.95)	(0.81)	(1.88)	(2.81)	(1.94)	(1.96)
Sargan Test *(p. value)*	-	0.000	0.008	0.000	0.544	0.135	0.233
Observations	537	492	492	492	514	492	492
Number of cross sections	23	23	23	23	23	23	23

Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. Imports to GDP is the ratio of total imports (goods and sevices) to GDP. Import price inflation * Imports to GDP is the product of Import price inflation and Imports to GDP. All estimations include country dummies not reported. All estimations include a constant term. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Hausman test carried out for IV estimations always reject the null that OLS estimation is consistent. Cf. appendix for instrument list for IV estimations.

Econometric estimations however show that it is definitely not: in the above table a horse race is run between import price inflation and the interaction of import price inflation with imports to GDP. Apart from the simple WITHIN estimation (which is there for illustrative purpose only as the specification test of OLS validity is rejected) all other estimations show that the significant impact of import price inflation on CPI inflation does not go through the volume

[11] Cf. Guilloux, Kharroubi « Evidence on the globalisation impact on producer prices at the industry level » forthcoming 2008.

of imports to GDP but is constant whatever the volume of imports to GDP with this last effect being between 0.16 and 0.21. This means that openness to trade has no significant impact on the sensitivity of CPI inflation to import price inflation[12].

This finding has two consequences. First it implies that every thing else equal, globalization defined as the increase in trade flows, does not significantly impact the relationship between import price inflation and CPI inflation. Whether globalization contributes to increase or decrease inflation through higher or lower import price inflation, a higher trade exposure does not significantly amplify these effects. Hence based on this result, it can be claimed that globalization has had no impact on the inflation process. The view that larger exposition to trade with emerging "low cost" countries tends to amplify the disinflation mechanism -the entrance of developing countries into world trade allowing mature economies to import a bunch of goods at much cheaper rates- is wrong. Secondly this finding can be interpreted as the fact that import price inflation is a sufficient statistics of the impact of foreign influence on domestic CPI inflation in the sense that changes in the composition of trade flows – emerging "low cost" countries substituting mature economies" – are already embedded in the import price inflation variable as greater exposition to trade with "low cost" countries may reduce import price inflation proportionally to the importance of these trade flows. What remains puzzling is why the volume effect –the increase in total imports to GDP- which cannot be embedded into the import price inflation variable has no significant explanatory power. One reason can be that the first order effect of the last globalization wave has been not so much an increase in the size of trade flows but rather more a change in the composition of trade flows, which are more and more North-South trade and less and less North-North trade. During the 80's the first order change in trade in G7 was the composition of trade, the volume being roughly constant as a share of GDP. On the contrary, the 90's show an increase in the share of Asian countries in G7 imports that is approximately similar to the increase in overall imports to GDP.

We hence need another explanation to account for the fact that the volume of imports to GDP does not significantly impact the pass-through of import price inflation to CPI inflation. One other possible explanation to this puzzling finding is that the effect of the volume of trade

[12] This result is robust to the inclusion of control variables such as monetary policy credibility. Cf. table 2 in appendix "Robustness tests"

may be relevant but only for some type of goods. This is the possibility we investigate in the next regressions[13].

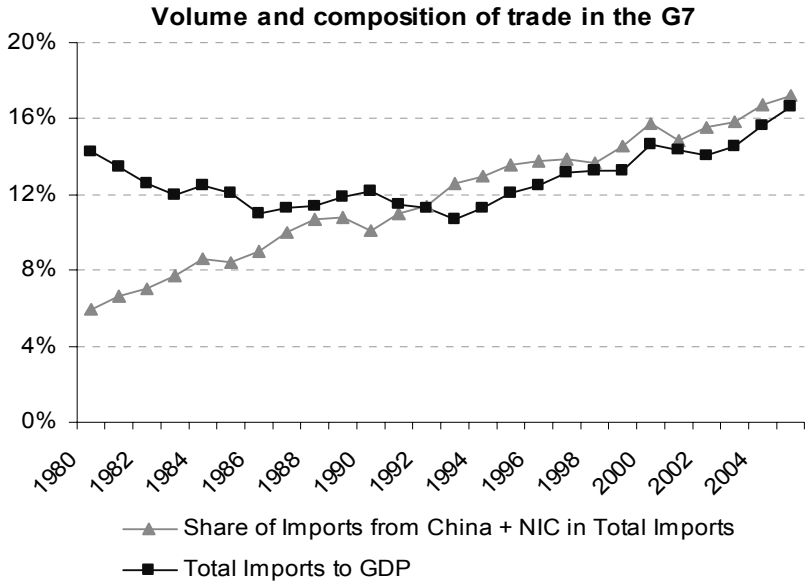

Chart 3

Note: China + NIC = China, Korea, Hong Kong, Singapore, Taiwan, Malaysia, Philippines, Thailand. *Source CHELEM*

Intuitively the impact of import price inflation on CPI inflation should be qualitatively different depending upon whether the goods that are being imported are also being produced domestically or not. In the latter case -where imports are not substitutes to domestic output-, import price inflation should typically impact CPI inflation according to the volume of goods imported because there is no possible impact on domestic producers' pricing behaviour. On the contrary, in the former case -where imports are substitutes to domestic output-, import price inflation could impact CPI inflation independently of the volume of goods imported because domestic producers may take into account foreign competition brought by imports in their pricing behaviour. To examine this possibility, we divide imports into two categories, commodity and non-commodity imports. The simple conjecture we base on our study is that non-commodity imports are more substitutes to domestic output in industrialized OECD countries than commodity imports. If a country imports commodity goods, it means that it lacks the natural resources to produce these commodities. On the contrary, there is no need to import commodities for a country that already produces these commodities. For instance a country like Japan which lacks natural resources for both agricultural output and raw materials shows the highest share of commodity imports in total imports in our sample (40%

[13]The effect of import price inflation on CPI inflation could also be unrelated to the ratio of imports to GDP if changes in import price inflation were due to world global shocks. However as will be shown in the next sections, changes to import price inflation have essentially been country specific which precludes this possibility.

in 2005). On the contrary Norway which is an oil exporter country shows a much lower share of commodity imports in total imports (more than twice lower).

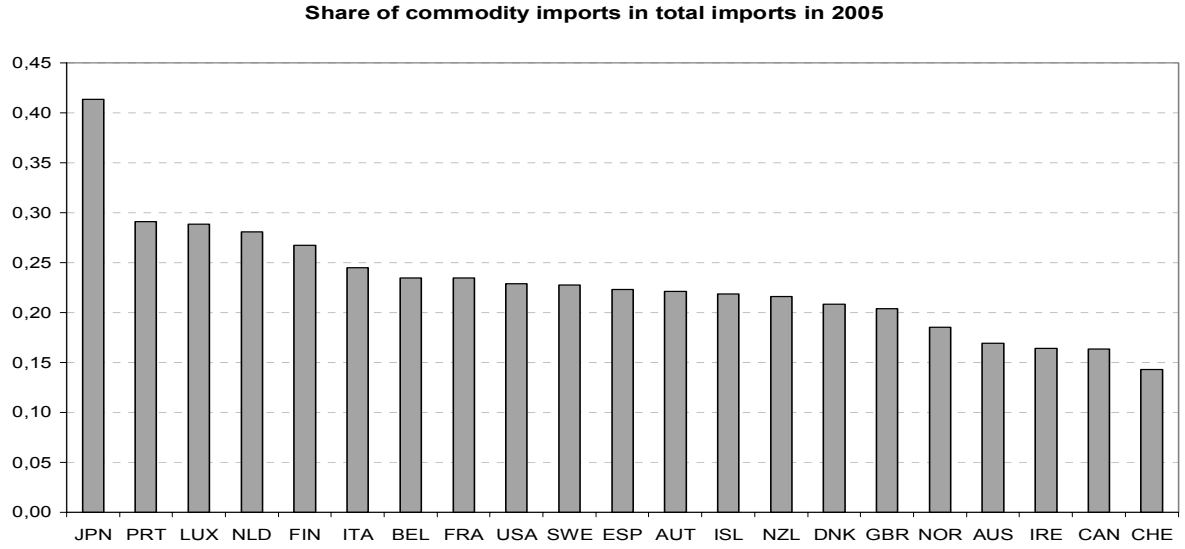

Chart 4

Separating import price inflation into commodity vs. non commodity import price inflation yields two interesting results. First consistent with the interpretation linking the goods that are being imported with how easily imports can substitute domestic output, commodity import price inflation is found to affect CPI inflation but only through the volume of commodity import price inflation.

Table 5

Separating into commodity and non commodity import price inflation

Estimations	1	2	3	4	5	6	7
Dependent variable: **Annual CPI Inflation**	OLS	IV	IV	IV	IV	IV	IV
Lagged CPI inflation	0.199***	0.598***	0.497***	0.497***	0.478***	0.588***	**0.584*** **
	(4.76)	(7.60)	(6.90)	(4.87)	(7.55)	(9.40)	**(8.99)**
Output Gap	0.124***	0.269***	0.217***	0.217***	0.214***	0.273***	0.269***
	(3.22)	(4.00)	(3.63)	(3.55)	(5.18)	(5.8)	**(5.99)**
Commodity Import price inflation	0.012**	0.006	-0.017	-0.017	-0.017	0.005	
	(2.03)	(0.27)	(1.15)	(1.09)	(1.74)	(0.33)	
Commodity Import price inflation * Com. Imports to GDP	0.035	0.153	0.414**	0.414***	0.418**	0.192**	**0.236*** **
	(0.64)	(0.72)	(2.53)	(2.17)	(2.88)	(1.79)	**(3.72)**
Non Com. Import price inflation	0.065***	0.087	0.087*	0.087*	0.092**	0.083*	**0.073*** **
	(2.63)	(1.40)	(1.70)	(1.76)	(2.11)	(1.86)	**(2.82)**
Non Com. Import price infl. * Non Com. Imports to GDP	0.033	-0.052	0.062	0.062	0.035	-0.043	
	(0.34)	(0.25)	(0.34)	(0.36)	(0.28)	(0.30)	
Sargan Test *(p. value)*	-	0.877	0.013	0.013	0.047	0.981	0.99
Observations	462	419	419	419	419	419	419
Number of cross sections	23	23	23	23	23	23	23

Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. Imports to GDP is the ratio of total imports (goods and sevices) to GDP. Import price inflation * Imports to GDP is the product of Import price inflation and Imports to GDP. All estimations include country dummies not reported. All estimations include a constant term. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Hausman test carried out for IV estimations always reject the null that OLS estimation is consistent. Cf. appendix for instrument list for IV estimations.

On the contrary non commodity import price inflation affects CPI inflation similarly whatever the volume of non commodity imports. An increase in the volume of non commodity imports has therefore no impact on CPI inflation. An interpretation to this qualitative difference can be based on the difference in competition: non-commodity goods face contestability in the sense that the pricing power of producers is necessarily limited by the fact that foreign producers can provide the domestic market with goods that can be relatively close. Even if the actual volume of imports is low, the threat of large imports triggered by arbitrage opportunities in prices generates an impact on domestic inflation. On the contrary this line of reasoning does not apply to commodity goods which are imported in as much as they cannot be produced domestically (think of oil for instance). To put it differently, a law of one price holds to a large extent for non commodity goods while nothing as such holds for commodities. Hence the prevalence of non commodity imports in total imports can account for the previous result that total import price inflation affects CPI inflation independently of the volume of total imports. Second considering a country where commodity imports roughly represent 10% of GDP (average value for 2005 in our sample), estimations in column 6 and 7 show that the effect on CPI inflation of 1pp increase in non commodity import price inflation is approximately three to four times larger than the effect of a 1pp increase in commodity import price inflation. Hence considering the case where import price inflation for non-commodity decreases while it increases for commodity goods, a decrease in non-commodity import price inflation reduces CPI inflation as long as it is at least 30% larger than the increase in commodity import price inflation.

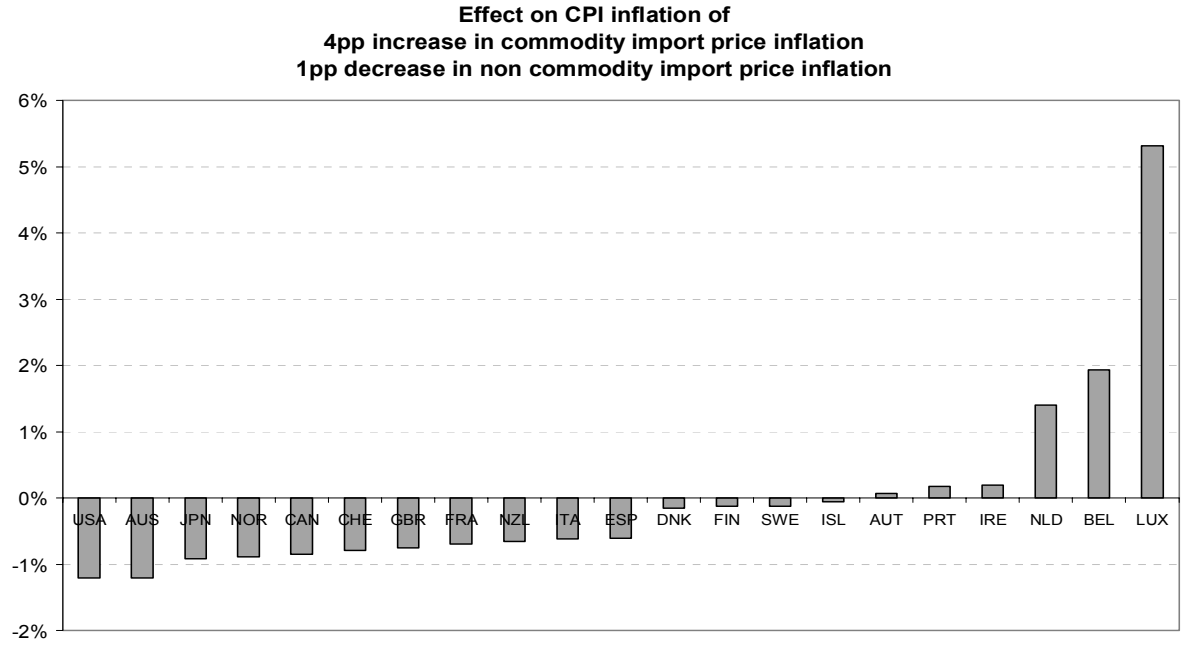

Chart 5

The implications of these results for the possible future impact of globalization on inflation are quite straightforward. Because globalization tends on the one hand to increase commodity goods inflation as well as raise OECD countries commodity imports especially as reserves in traditional oil producers (the UK for instance) are getting exhausted. Because on the other hand nominal convergence in developing countries will at some point translate into higher non-commodity import price inflation for OECD countries (especially for those that have large trade links with emerging economies for manufactured goods), it is likely that globalization will contribute to raise CPI inflation in OECD countries.

These results provide evidence that the nature of goods traded is fundamental to properly evaluate the effects of openness to trade on inflation. More precisely substitutability between domestic output and imports seems to be a key element to evaluate the relationship between inflation and openness. While the previous analysis has provided a simple dichotomy in imports, it is possible to dig in this way more systematically. This is what the next section tries to achieve.

IV. TRADE STRUCTURE AND THE INFLATION PROCESS.

Traditional trade theory has for long been confronted to the difficulty of accounting for major trade flows. While the latter are essentially about trading goods that can be quite similar to what importing economies do already produce, traditional trade theory –the Hescksher-Ohlin-Samuelson (HOS) approach in particular- has highlighted the importance of relative factor endowments, pointing to the fact that economies should import goods that are relatively intensive in the domestically scarce factor. These factor endowments motives for trade are important but do not seem to apply well to the major part of developed countries trade flows. Recent work on these issues has shown that trade could occur for some goods already domestically produced as long as consumers exhibit a taste for variety and competition is endogenous to the number of producers for a given market. This type of trade named as intra-industry trade is opposed to inter-industry trade which is well described with a standard HOS model.

The structure of trade, i.e. imports as a substitute or a complement to domestic output, can empirically be traced with the Grubel-Lloyd index which writes as follows

$$IIT_j = 1 - \frac{\left|X_j - M_j\right|}{X_j + M_j}$$

where *IIT* is the intra-industry trade index for a given sector *j*, *X* is the value of exports and *M* the value of imports for the given sector *j*. When the value of exports is relatively similar to the value of imports in a given sector, the index is close to one. On the contrary when exports are much lower or much larger than imports, then the index is close to zero. At the macro level, an intra-industry trade index can be computed as follows:

$$IIT = 1 - \frac{\sum_j \left|X_j - M_j\right|}{\sum_j \left(X_j + M_j\right)}$$

trade in all sectors *j* being taken into account. IIT close to 1 indicates that the nature of exports is close to that of imports whereas IIT close to 0 reflects that imports are relatively different from exports. There are four limits to the use of these indexes for our purpose. The most obvious one is that the intra-industry trade index grasps the proximity between imports and exports, not between imports and domestic output. While this is theoretically a problem, we try to address it using an index for import penetration ratio computed for industry *j* as

$$MPEN_j = \frac{M_j}{Q_j + X_j - M_j}$$

Domestic output for a given sector *j* is Q_j. At the country level, the import penetration ratio is computed as

$$MPEN = \frac{\sum_j M_j}{\sum_j \left(Q_j + X_j - M_j\right)}$$

A large value for the import penetration ratio implies that domestic demand is mainly fulfilled by imports and domestic production tends to be exported whereas a value close to zero that domestic demand is mainly satisfied by domestic production. The second limit with the intra industry Trade index relates to the scope of these indexes build on data for the manufacturing sector whose share in total output is shrinking and does not take into account the recent wave of services off-shoring which can be a powerful mechanism to influence domestic inflation in mature economies. Thirdly the reliability of these indexes highly depends on the precision of the industrial classification they are built on, especially the desegregation level. In what follows we use two intra-industry trade indexes, one coming from the STAN OECD dataset containing approximately 25 different industries and another one coming from the CHELEM

CEPII dataset based on decomposition for 70 different industries. Finally, the Grubel-Lloyd index computed at the macroeconomic level can be sensitive to the global trade balance of the economy. While some measures correcting that bias do exist in the literature, they have not proven to bring sizeable improvements. To make sure this applies to our study we provide estimations where we control for the trade balance (see appendix, Robustness tests, Table 7)

The upside to using this type of measures is also clearly identified. Among these, lies the very notion that globalization effects are fundamentally incentive effects that do not necessarily materialize with trade flows. Nor do trade flows grasp these incentive effects as they probably emerge when incentive mechanisms fail to achieve the necessary changes. To put it differently in an open economy, the absence of trade flows can be a sign of integration because this means that domestic producers modify their prices as to eliminate any arbitrage opportunity. On the contrary observing trade flows typically means that some arbitrage opportunity that domestic agents have not filled on is being exploited by foreigners. The larger the share of domestic producers that are confronted with the law of one price, the higher the integration and the lower the trade flows. The basic advantage of the intra-industry trade index is precisely to capture the intensity of this incentive channel whatever the volume of trade.

The intensity of intra-industry trade can affect inflation in two ways. First it can affect the sensitivity CPI inflation to the output gap and second it can influence the sensitivity CPI inflation to import price inflation.

Table 6

Globalization represented by IIT and/or imports to GDP

Estimations	1	2	3	4	5	6	7	8
Dependent variable: **Annual CPI Inflation**	OLS	IV	IV	IV	OLS	IV	IV	IV
Lagged CPI inflation	-0.086**	0.482***	0.768***	0.716***	0.007***	0.392**	0.552***	0.549***
	(2.02)	(3.12)	(4.15)	(4.58)	(0.18)	(2.48)	(5.51)	(5.31)
Output Gap	-0.412*	2.155***	2.932**	2.866**	-0.001	0.310***	0.397***	0.390***
	(1.85)	(4.79)	(2.23)	(2.42)	(0.02)	(3.82)	(3.22)	(3.29)
Output Gap * Imports to GDP	-0.794*	0.130	0.384	0.472				
	(1.74)	(0.21)	(0.45)	(0.53)				
Output Gap * IIT	0.010***	-0.028***	-0.039**	-0.038**				
	(3.21)	(4.22)	(1.99)	(2.19)				
Import price inflation	0.149***	0.260*	0.153***	0.174***	0.327***	0.483***	0.372***	0.409***
	(9.24)	(1.87)	(2.72)	(2.94)	(7.79)	(2.80)	(3.30)	(2.69)
Import price inflation * Imports to GDP					0.629***	0.502	0.396	0.223
					(6.36)	(1.55)	(1.41)	(0.88)
Import price inflation * IIT					-0.007***	-0.008***	-0.006***	-0.006***
					(10.53)	(2.83)	(2.84)	(2.77)
Sargan Test *(p. value)*	-	0.001	0.065	0.440	-	0.004	0.023	0.230
Observations	472	428	428	428	493	450	450	450
Number of cross sections	23	23	23	23	23	23	23	23

Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. Imports to GDP is the ratio of total imports (goods and sevices) to GDP. Import price inflation * Imports to GDP is the product of Import price inflation and Imports to GDP. IIT is the Intra Industry Trade index measured with the Grubel Loyd method. All estimations include country dummies not reported. All estimations include a constant term. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Hausman test carried out for IV estimations always reject the null that OLS estimation is consistent. Cf. appendix for instrument list for IV estimations.

In columns 1 to 4, we test whether intra-industry trade affects the sensitivity CPI inflation to the output gap, i.e. the slope of the Phillips curve. Instrumental variable regressions (2-4) show that the interaction coefficient between the output gap and the intra-industry trade index is significant and negative while the interaction of the output gap and the imports to GDP ratio is not. This means that the intra industry trade tends to dampen the effect of the output gap on CPI inflation. The slope of Phillips curve is lower when the intra-industry trade index is lower, i.e. when imports and exports are closer substitutes. Hence higher index for intra-industry trade index is a candidate to account for the general phenomenon of Phillips curve flattening. On the contrary the volume of goods imported has no significant impact on the slope of the Phillips curve, this last result being in line with the literature.

The economic intuition for this result is straightforward. A positive shock on output gap is less inflationary when domestic producers are more constrained by global competition. Raising prices in such case would induce market shares losses, the loss being larger when imports are close substitutes to domestic output. This result systematizes the intuition of Borio and Filardo (2007): imports can act as a buffer in the domestic supply and demand equilibrium, hence reducing the sensitivity of domestic inflation to domestic output. However for this property to hold, we need that imports can easily replace domestic output in terms of the goods consumed. This is what we capture through with our intra-industry trade measure. Besides avoiding the caveats of foreign output gap data building, intra-industry trade provides a simple measure of how globalization has contributed to the decline in the inflation sensitivity to domestic economic slack.

Intra-Industry Trade index Empirical Cumulative Distribution Function.

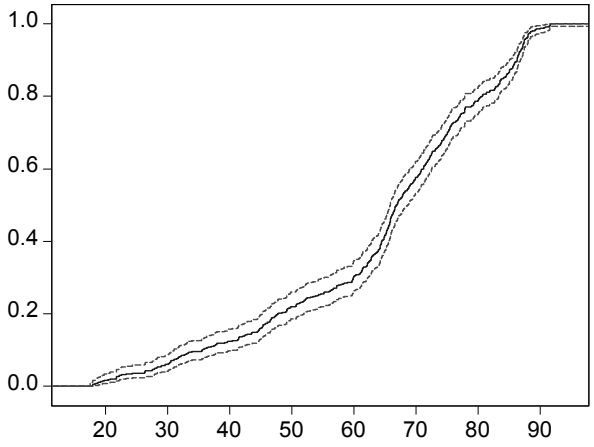

Chart 6

To measure of the magnitude of the effect on Phillips curve flattening, we derive the change in the slope of the Phillips curve when moving from the first to the third quartile of our sample distribution of intra-industry trade. The 25% and 75% percentiles for IIT being respectively around 54% and 77%, the slope of the Phillips curve would go down from 0.8 to approximately zero[14].

The impact of IIT on the slope of the Phillips curve.

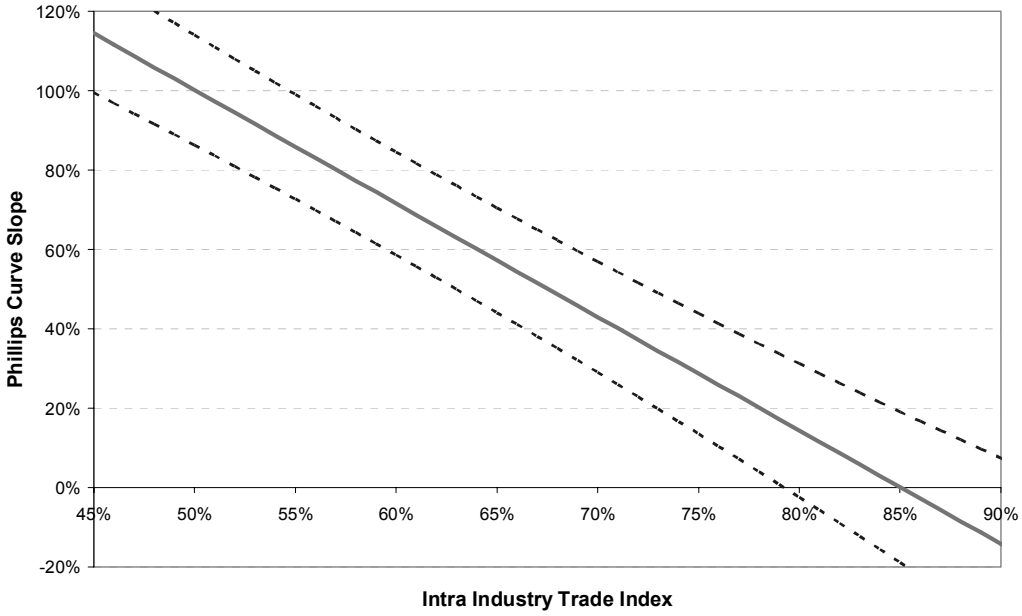

Chart 7

In columns 5 to 8 of table 6, we use the same method to test whether intra industry trade accounts for low import price pass through. As in the previous case, the interaction between import price inflation and intra-industry trade has a significant and negative effect on CPI inflation while the interaction between import price inflation and the imports to GDP ratio is not significant (columns 6-8). The higher the intra-industry trade index, the weaker the sensitivity of CPI inflation to import price inflation. Hence a positive shock on import price inflation produce a lower increase in CPI inflation as domestic producers can more easily substitute imports when trade is more intra-industry.

Meanwhile, this result highlights a paradox. While the literature has concluded that globalization has had no significant role on inflation based on the low pass-through of import price inflation to CPI inflation, we argue that this low pass-through is indeed due to a specific pattern of globalization in industrialized economies, the importance of intra vs. inter industry

[14] The green line represents the average estimated slope. The dashed lines represent the average estimated slope plus or minus one standard deviation.

trade. These shows that import prices do not constitute a sufficient statistics to assess the effects of globalization on inflation.

V. TRADE STRUCTURE AND THE INFLATION PROCESS: SOME ROBUSTNESS CHECKS.

The impact of intra-industry trade.

The last regressions provide the surprising conclusion that the ratio of imports to GDP does not play any role in the relationship between on the one hand CPI inflation and on the other hand output gap and import price inflation. To check whether this conclusion is robust we introduce another term to capture whether the impact of the trade structure on these relationships depends upon the volume of trade. Is it the case that in a more open country, CPI inflation will be significantly more sensitive to import price inflation for a given level of intra-industry trade index? Regressions in appendix[15] show that this is not the case. Whatever the relationship and the specification considered, when IIT is introduced, the interaction of IIT and imports to GDP is never a significant determinant of the relationship between CPI inflation and the output gap or import price inflation. More generally the impact of IIT on the slope of the Philips curve and/or on the pass-through of import price inflation to CPI inflation could be a proxy for a number of features that affect or could affect the Phillips curve such as monetary policy credibility, labour market characteristics, or financial openness. We show in appendix (table7) that the impact of intra-industry trade is robust to the inclusion of all these variables[16].

Alternative measures of intra-industry trade.

Two of the limits to the use of the index for IIT that were described above can be addressed. First we can focus on an aggregate import penetration ratio based on industry level data to get an idea how close are the goods imported to domestic output and not exports. Second we can use a more desegregate industry decomposition to compute another index for intra-industry trade. Results in appendix show that the industry decomposition has no particular impact on the results. In particular the index for IIT computed at a more desegregate level still has a significant and negative effect on the slope of the Phillips curve and it also tends to dampen the effect of import price inflation on CPI inflation. Hence the desegregation level of our

[15] Cf. table 3, table 4 and table 5 in appendix "Robustness tests"

index for IIT does not seem to play any role in our results. As concerns using the import penetration ratio in place of the index for intra-industry trade, it seems that it is a significant determinant of the slope of the Phillips curve. Moreover when compared with the ratio of imports to GDP, it does a better job since the effect of the latter on the slope of the Phillips curve is not robust to the inclusion of time dummies.

Intra-industry trade and competition.

We have grounded our interpretation of the effect of intra-industry trade on the Phillips curve on the basis that intra-industry trade does proxy the pro-competitive effect of trade namely that countries where trade is more intra-industry are also countries where domestic producers are more constrained in their pricing by international competition. However it may be argued that intra-industry trade arises when there is imperfect competition while inter-industry trade arises with perfect competition. Hence competition would be inversely related to the extent of intra-industry trade. This view is wrong for two reasons. First in new trade theory models (Melitz (2003)), globalization -as a fall in transaction and/or transport costs- tends to increase both competition and intra-industry trade. Hence the view that intra-industry trade is inversely related to competition is not always true from a theoretical point of view. Second and more importantly, empirical evidence at the industry level shows that the negative impact of industry productivity shocks on industry real output price inflation tends to be larger when the intra-industry trade index is larger[17]. Industries where the impact of supply shocks on prices tends to be larger are typically industries where competition is larger. Hence our interpretation is totally consistent with the industry level empirical evidence and higher intra-industry trade cannot be associated with lower competition. Finally the result that higher intra-industry trade tends to reduce the slope of the Philips curve relates not that much to the level of mark-ups but more to the cyclicality of mark-ups. In economies where intra-industry trade is larger mark-ups are less pro-cyclical because the capacity of domestic producers to raise prices in good times is lower when the threat of imports, i.e. intra-industry trade, is larger. Indeed, Cohen and Farhi (2001) argue that a key difference between the US and the European Phillips curves lies in the behaviour of mark-ups which are more counter-cyclical in Europe than in the US.

[16] Tables 8, 9 and 10 in appendix also show that the impact of intra-industry trade on the slope of the Phillips curve neither depends on a particular country of the sample nor on the particular sample period we use.

[17] Cf. Guilloux, Kharroubi « Evidence on the globalisation impact on producer prices at the sector level » forthcoming 2008

International output fragmentation.

Up to now, we have considered intra-industry trade as trade in similar goods, i.e. goods that belong to the same industry. On the basis of this view we have interpreted intra-industry trade as a measure of the extent to which domestic producers are constrained by foreign competition. However given that the industry classifications we consider, it may likely be that intra-industry trade does not represent the constraint on the pricing power of domestic producers but the international fragmentation of production. For example if we consider some industry which implies some high tech components, developed countries may well export the high tech components to some developing countries where assembly is carried out. After the assembly stage, the final good may be imported to the country which had exported in the first place the high tech components. This type of trade typically contributes to raising indexes for intra-industry trade while that does not impact the pricing power of domestic producers. While our contestability based interpretation is not valid here, this case is however entirely consistent with a very simple interpretation: assuming that intra-industry trade reflects international output fragmentation, a higher index for intra-industry trade basically implies that domestic conditions have lower impact on the price of the final good as a large share of output is carried out abroad. This argument also applies for the pass-through of import prices to CPI inflation: higher intra-industry trade means that a larger share of imports is dedicated to be embedded into exports. Hence CPI inflation is less sensitive both to import price inflation and domestic output gap when intra-industry trade is larger or when output is more fragmented at the international level.

GDP deflator and IIT.

As import prices can create a « pro-competitive» effect on domestic producers, the impact of globalization on inflation should be observed not only on CPI inflation, but also on GDP deflator inflation. We hence carry out regression using GDP deflator instead of CPI inflation as a dependent variable (see Appendix, Robustness Tests, Table 5). The results are qualitatively and quantitatively close to those with CPI inflation.

National or global shocks.

A final possible limit to the argument that intra-industry trade tends to lower the sensitivity of inflation to both import price inflation and output gap relates to the nature of shocks that affect the output gap or the import price inflation. If an economy is hit by a global shock, this

implying that its trading partners are also hit by the same shock, there is no possibility to dampen the effect of such shock especially through higher intra-industry trade. Hence the interpretation we bring holds as long as shocks are mainly idiosyncratic to each country. To investigate this question we run a simple variance decomposition exercise on each of the import price inflation and output gap variables as follows

$$z_{it} = a_i + b_t + c_{it}$$

where z is the output gap of the import price inflation, b is a measure of global shocks that affect all countries in our sample and c is the idiosyncratic shock specific to both country i and time t. Based on this simple decomposition we compute for each country the following ratio

$$s_i = \frac{\sigma^2(c_{it})}{\sigma^2(b_t) + \sigma^2(c_{it})}$$

where $\sigma^2(x)$ is the conditional variance of x for each country i. What comes out of the next pictures is fairly clear. As far as import price inflation is concerned, for the vast majority of countries, the variance of idiosyncratic shocks is larger than the variance of global shocks.

Relative variance of idiosyncratic shocks to import price inflation
1980-2005

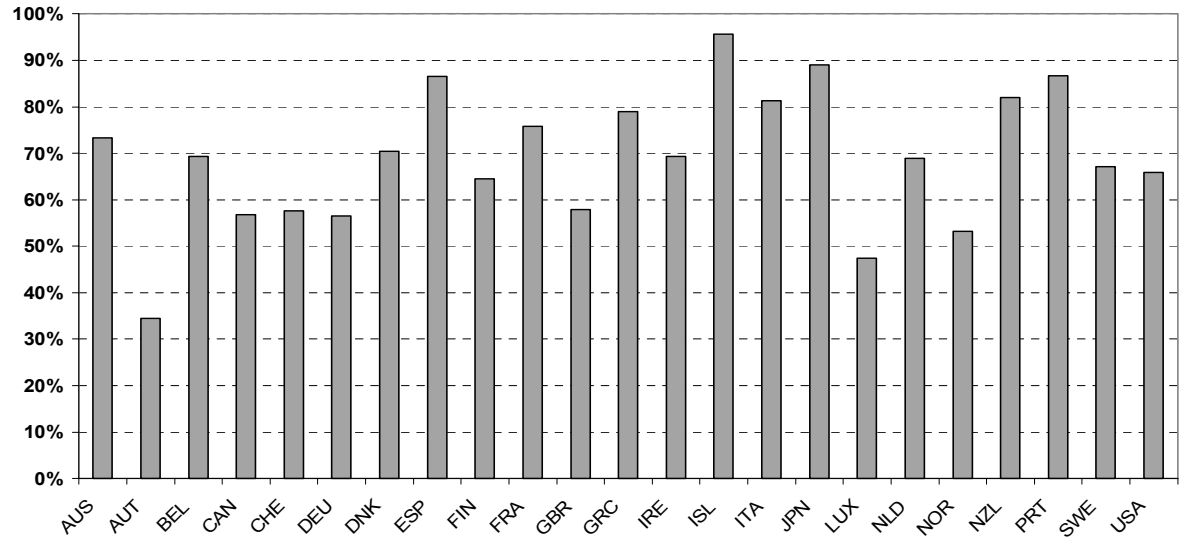

Chart 8

Only in the case of Austria and Luxembourg is the variance of idiosyncratic shocks lower than the variance of global shocks. While the result is less clear cut for the output gap, it also holds. There are only three countries in the sample (Belgium, France and Italy) in which the variance of output gap shocks is higher for the global than for the idiosyncratic component.

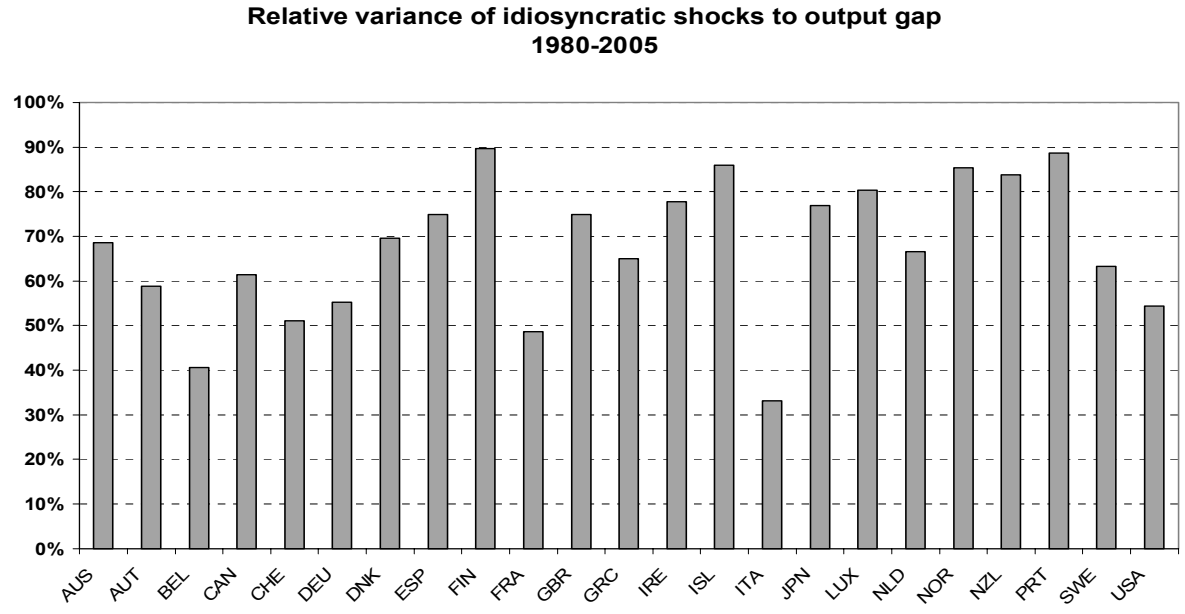

Chart 9

Hence the interpretation we have adopted is totally consistent with shocks on the output gap and/or on import price inflation which have mainly been idiosyncratic.

VI. CONCLUSIONS.

In this paper, we have tried to assess the impact of globalization on inflation. While different angles must be considered to get a broad view on this question, we have chosen to focus in this study on two main points; first the short run effect of globalization on inflation through the impact of import prices and second the impact of globalization on the inflation process and namely on the sensitivity of inflation to domestic output. We have derived two simple results on each of these issues. First the impact of import price inflation on CPI inflation is low and to a large extent independent of actual openness. Second the impact of domestic output gap on CPI inflation has been shown to depend negatively on the extent to which trade occurs within industries. Both these results are important for policy making. In the first case, it implies that further openness to trade does not necessarily imply that domestic inflation will be more sensitive to import price inflation. In the second case, if trade becomes more a within industry phenomenon, that can be goods news if inflationary pressures are less effective in producing inflation- but that can also be bad news because upward deviations from the inflation target will be more costly in terms of output loss. This highlights that globalization reinforces -through this last effect- the importance for monetary policy of anchoring inflation expectations through high credibility.

VII. REFERENCES

Allard, G. 2005, "Measuring Job Security over Time: In Search of a Historical Indicator for EPL (Employment Protection Legislation)" Instituto de Empresa Business School Working Paper n°05-17.

Allard, G. 2005, "Measuring the Changing Generosity of Unemployment Benefits: Beyond Existing Indicators" Instituto de Empresa Business School Working Paper n°05-18.

Ball, L. M., 2006, "Has Globalization Changed Inflation?" NBER Working Paper n° 12687

Borio, C. and A. Filardo, 2007, "Globalization and Inflation: New Cross-Country Evidence on the Global Determinants of Domestic Inflation," mimeo, Bank for International Settlements, Basel, Switzerland (March)

Boulhol, H., 2005, "Why Haven't Price-Cost Margins Decreased with Globalization?" Mimeo MSE.

Chen, N., J. Imbs and A. Scott, 2004, "Competition, Globalization and the Decline of Inflation," CEPR Discussion Paper n° 4695

Cohen, D. and E. Farhi, 2001, "The Phillips Curves across the Atlantic: It's the Price Curves that Differ," CEPR Discussion Paper n°3100.

Dixit, A. & J. Stiglitz, 1977, "Monopolistic Competition and Optimum Product Diversity", American Economic Review, American Economic Association, vol. 67(3), pages 297-308, June

ECB, 2006, "Effects of the rising trade integration of low-costs countries on Euro area import prices", Monthly Bulletin, August, pp56-57

Frey, L., Moëc G., 2006, "Vers une intensification des tensions inflationnistes globales? ", Bulletin Mensuel de la Banque de France, août

Gamber, E., and J. Hung, 2001, "Has the rise in globalization reduced US inflation in the 1990's", Economic Inquiry, vol. 39 (1), pp. 58-73

Grubel, H. and P.J. Lloyd, 1975, "Intra-Industry Trade", Macmillan, London

International Monetary Fund, 2006, "How Has Globalization Changed Inflation?" World Economic Outlook, Washington, D.C.: IMF, April, pp. 97-134

Ihrig, J., S. Kamin, D. Lindner and J. Marquez, 2007, "Some Simple Tests of the Globalization and Inflation Hypothesis," Board of Governors of the Federal Reserve System.

Hoekman, B., M. Olarreaga, and H.L. Kee, 2001, "Markups, Entry Regulation, and Trade: Does Country Size Matter?", World Bank Policy Research Working Paper n° 2662

Kamin, S., M. Marazzi and J. W. Schindler, 2006, "The impact of Chinese exports on global import prices, Review of International Economics, vol.14, pp. 179-201

Kramarz F., 2003, "Wages and International Trade", mimeo CREST, Paris

Lane, P.R., 1997, "Inflation in open economies", Journal of International Economics, Elsevier, vol. 42(3-4), pages 327-347, May

Laxton, D. and P N'Diaye, 2002, "Monetary Policy Credibility and the Unemployment-Inflation Tradeoff: Some Evidence from 17 Industrial Countries" IMF Working Papers n° 02/220

Loungani, P. and A. Razin, 2005, “Globalization and Disinflation: The Efficiency Channel” CEPR Discussion Paper n° 4895

Melitz, M., 2003, “The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity”, Econometrica vol. 71

Oliveira Martins, J., 1994, “Market Structure, Trade and Industry Wages, OECD Economic Studies, 22

Pain, N., I. Koske and M. Sollie, 2006, “Globalization and Inflation in the OECD Economies,” Economics Department Working Paper No. 524, OCDE, Paris (November)

Rogoff, K., 2004, “Globalization and Global Disinflation”, Federal Reserve Bank of Kansas City conference on "Monetary Policy and Uncertainty: Adapting to a Changing Economy"

Romer, D., 1993, “Openness and Inflation: Theory and Evidence”, the Quarterly Journal of Economics, vol. 108(4), pp.869-903

Woodford, M., 2007, “Globalization and Monetary Policy Control”, NBER, n° 13329.

APPENDIX.

List of countries in the sample

Australia, Austria, Belgium, Canada, Switzerland, Germany (post 1991), Denmark, Spain, Finland, France, Great-Britain, Greece, Ireland, Iceland, Italy, Japan, Luxembourg, Netherlands, Norway, New-Zealand, Portugal, Sweden, United States.

Items under the "Commodity" heading

Food and live animals, Beverages and tobacco, Crude materials, Mineral fuels, lubricants and related materials, Animal and vegetable oils and fats.

Items under the "Non-Commodity" heading

Chemicals and related products, Manufactured goods, Machinery and transport equipment, Miscellaneous manufactured articles.

Data Sources

Variable	Source
Headline CPI	Economic Outlook
GDP deflator	Economic Outlook
Domestic output gap	Economic Outlook
Price of imports	Economic Outlook
Imports (national level)	Economic Outlook
Price of commodity imports	Economic Outlook
Price of non commodity imports	Economic Outlook
Commodity imports	Monthly Trade Statistics
Non commodity imports	Monthly Trade Statistics
Imports (industry level)	STAN and CHELEM
Exports (industry level)	STAN and CHELEM
Output (industry level)	STAN

List of sectors used to compute the intra-industry trade index and the import penetration ratio based on STAN data

Sector	ISIC
Food products, beverages and tobacco	15-16
Textiles, Textile products, Leather and footwear	17-19
Wood and products of wood and cork	20
Pulp, paper, paper products, printing and publishing	21-22
Coke, refined petroleum products and nuclear fuel	23
Chemicals and chemical products	24
Rubber and plastics products	25
Other non-metallic mineral products	26
Basic metals	27
Fabricated metal products, except machinery and equipment	28
Machinery and equipment, n.e.c.	29
Office, accounting and computing machinery	30
Electrical machinery and apparatus, n.e.c	31
Radio, television and communication equipment	32
Medical, precision and optical instruments	33

Motor vehicles, trailers and semi-trailers	34
Other transport equipment	35
Manufacturing n.e.c; Recycling	36-37

List of sectors used to compute the intra-industry trade index based on CHELEM data

Code	Sector	Code	Sector
BA	Cement	FU	Commercial vehicles
BB	Ceramics	FV	Ships
BC	Glass	FW	Aeronautics
CA	Iron Steel	GA	Basic inorganic chemicals
CB	Tubes	GB	Fertilizers
CC	Non ferrous metals	GC	Basic organic chemicals
DA	Yarns fabrics	GD	Paints
DB	Clothing	GE	Toiletries
DC	Knitwear	GF	Pharmaceuticals
DD	Carpets	GG	Plastics
DE	Leather	GH	Plastic articles
EA	Wood articles	GI	Rubber articles (incl. tyres)
EB	Furniture	HA	Iron ores
EC	Paper	HB	Non ferrous ores
ED	Printing	HC	Unprocessed minerals n.e.s.
EE	Miscellaneous manuf. articles	IA	Coals
FA	Metallic structures	IB	Crude oil
FB	Miscellaneous hardware	IC	Natural gas
FC	Engines	IG	Coke
FD	Agricultural equipment	IH	Refined petroleum products
FE	Machine tools	II	Electricity
FF	Construction equipment	JA	Cereals
FG	Specialized machines	JB	Other edible agricultural prod
FH	Arms	JC	Non-edible agricultural prod.
FI	Precision instruments	KA	Cereal products
FJ	Clock making	KB	Fats
FK	Optics	KC	Meat
FL	Electronic components	KD	Preserved meat/fish
FM	Consumer electronics	KE	Preserved fruits
FN	Telecom equipment	KF	Sugar
FO	Computer equipment	KG	Animal food
FP	Domestic electrical appliances	KH	Beverages
FQ	Electrical equipment	KI	Manufactured tobaccos
FR	Electrical apparatus	NA	Jewellery, works of art
FS	Vehicles components	NB	Non-monetary gold
FT	Cars and cycles	NV	N.e.s. products

Table 1: list of instruments

Estimations	1	2	3	4	5	6	7
CPI inflation lag2		X				X	
CPI inflation lag3		X	X	X		X	X
Output Gap lag2		X	X	X	X	X	X
Output Gap lag3		X	X	X	X	X	X
Import price inflation lag2				X	X		X
Import price inflation lag3				X	X		X
Time dummy						X	X

Table 2: list of instruments

Estimations	1	2	3	4	5	6	7
CPI inflation lag2		X					
CPI inflation lag3		X	X	X		X	
Output Gap lag2		X	X	X	X	X	X
Output Gap lag3		X	X	X	X	X	X
Import price inflation lag2		X	X	X	X	X	X
Import price inflation lag3		X	X	X	X	X	X
Robust				X			
Time dummy						X	X

Table 3: list of instruments

Estimations	1	2	3	4	5	6	7
CPI inflation lag2		X					
CPI inflation lag3		X	X				
Output Gap lag2		X	X	X	X	X	X
Output Gap lag3		X	X	X	X	X	X
Import price inflation lag2						X	X
Import price inflation lag3						X	X
(Import price inflation* Imports to GDP) lag2		X	X	X	X	X	X
(Import price inflation* Imports to GDP) lag3		X	X	X	X	X	X
Robust							
Time dummy					X		X

Table 4: list of instruments

Estimations	1	2	3	4	5	6	7
CPI inflation lag2		X		X			
CPI inflation lag3		X	X	X			
Output Gap lag2		X	X	X	X	X	X
Output Gap lag3		X	X	X	X	X	X
Import price inflation lag2		X	X	X	X	X	X
Import price inflation lag3		X	X		X	X	X
(Import price inflation* Imports to GDP) lag2		X	X	X	X	X	X
(Import price inflation* Imports to GDP) lag3		X	X	X		X	X
Imports to GDP lag2							
Imports to GDP lag3							X
Robust					X	X	X
Time dummy					X		

Table 5: list of instruments

Estimations	1	2	3	4	5	6	7
CPI inflation lag2		X	X		X	X	X
CPI inflation lag3		X	X		X	X	X
Output Gap lag2		X	X	X	X	X	X
Output Gap lag3		X	X	X	X	X	X
Import price inflation lag2							
Import price inflation lag3							
(Import price inflation* Imports to GDP) lag2							
(Import price inflation* Imports to GDP) lag3							
Imports to GDP lag2							
Imports to GDP lag3							
Commodity Import price inflation lag2		X	X	X	X	X	X
Commodity Import price inflation lag3		X	X	X	X	X	X
(Com. Import price inflation* Com. Imports to GDP) lag2		X	X	X	X	X	X
(Com. Import price inflation* Com. Imports to GDP) lag3		X	X	X	X	X	X
Non Com. Import price inflation lag2		X	X	X	X	X	X
Non Com. Import price inflation lag3		X	X	X	X	X	X
(Non Com. Import price inflation*Non Com. Imports to GDP) lag2		X	X	X	X	X	X
(Non Com. Import price inflation* Non Com. Imports to GDP) lag3		X	X	X	X	X	X
Commodity Imports to GDP lag2					X		
Commodity Imports to GDP lag3					X	X	X
Commodity Imports to GDP lag4						X	X
Non Commodity Imports to GDP lag2					X		
Non Commodity Imports to GDP lag3					X	X	X
Non Commodity Imports to GDP lag4					X	X	X
Commodity Imports Share lag2					X	X	
Commodity Imports Share lag3					X	X	X
Commodity Imports Share lag4					X	X	X
Exports to GDP lag2						X	
Exports to GDP lag3						X	
Robust						X	X
Time dummy			X	X		X	

Table 6: list of instruments

Estimations	1	2	3	4	5	6	7	8
CPI inflation lag2		X				X		
CPI inflation lag3		X	X			X	X	
Output Gap lag2		X	X	X				
Output Gap lag3		X	X	X				
(Output Gap* Imports to GDP) lag2		X	X	X				
(Output Gap* Imports to GDP) lag3		X	X	X				
(Output Gap* IIT) lag2		X	X	X				
(Output Gap* IIT) lag3		X	X	X				
Import price inflation lag2						X	X	X
Import price inflation lag3						X	X	X
(Import price inflation* Imports to GDP) lag2						X	X	X
(Import price inflation* Imports to GDP) lag3						X	X	X
(Import price inflation* IIIT) lag2						X	X	X
(Import price inflation* IIT) lag3						X	X	X
Robust								
Time dummy								

Robustness Tests

Table 1

Phillips Curve with import price inflation and monetary policy credibility

Estimations	1	2	3	4	5	6
Dependent variable: **Annual CPI Inflation**	IV	IV	IV	IV	IV	IV
Lagged CPI inflation	0.506***	0.455***	0.303*	0.597***	0.400**	0.297
	(3.63)	(3.19)	(1.88)	(6.71)	(2.33)	(1.40)
Output Gap	0.441**	0.289***	0.220**	0.388***	0.263***	0.205***
	(2.19)	(3.50)	(2.21)	(3.31)		(4.07)
Import price inflation	0.150**	0.114***	0.141**	0.185**	0.077***	0.050***
	(1.99)	(2.63)	(2.40)	(2.32)	(4.53)	(2.70)
Monetary Policy Credibility		-0.037*	-0.021		-0.044**	-0.027
		(1.73)	(0.95)		(2.04)	(1.28)
Lagged Import price inflation				0.020	0.019	0.039**
				(0.36)	(1.47)	(2.27)
Observations	545	440	440	545	545	545
Number of cross sections	22	21	21	22	22	22

Note: Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. Monetary policy credibility is computed following the Laxton N'diaye (1997) formula. All estimations include country dummies not reported. Estimations 3 and 6 include also time dummies. Instruments used are the lag 2 and 3 of each of the explanatory variables apart from lagged CPI inflation. Absolute value of t statistics (robust to heteroscedasticity) in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Hausman test always reject the null that OLS estimation is consistent. Sargan test always accepts the null of the validity of instruments à the 10% level.

Table 2

Deciding between import price inflation and the interaction with imports to GDP

Estimations	1	2	Estimations	3
Dependent variable: **Annual CPI Inflation**	IV	IV	Dependent variable: **Annual GDP deflator Inflation**	IV
Lagged CPI inflation	0.531***	0.555***	**Lagged GDP deflator inflation**	0.715***
	(4.22)	(3.21)		(4.83)
Output Gap	0.451**	0.319***	**Output Gap**	0.327***
	(2.32)	(5.17)		(5.65)
Import price inflation * Imports to GDP	0.071	0.041	**Import price inflation * Imports to GDP**	0.091
	(0.51)	(0.22)		(0.46)
Import price inflation	0.122**	0.116*	**Import price inflation**	0.115**
	(2.22)	(1.74)		(1.73)
Monetary Policy Credibility		-0.025		
		(1.02)		
Observations	537	492	Observations	492
Number of cross sections	23	23	Number of cross sections	23

Note: Lagged CPI inflation is CPI inflation one year before. Lagged GDP deflator inflation is GDP deflator inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. Imports to GDP is the ratio of total imports (goods and sevices) to GDP. Import price inflation * Imports to GDP is the product of Import price inflation and Imports to GDP. All estimations include country dummies not reported. All estimations include a constant term. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Hausman test carried out for IV estimations always reject the null that OLS estimation is consistent. Sargan test (not reported) always accepts the validity of instruments.

Table 3

Globalization represented by IIT and/or imports to GDP

Estimations	1	2	3	4
Dependent variable: **Annual CPI Inflation**	IV	IV	IV	IV
Lagged CPI inflation	0.635***	0.624***	0.778***	0.734***
Output Gap	1.989***	1.506***	3.020***	2.238***
Output Gap * IIT(20)	-2.700***		-3.900***	
Output Gap * IIT(70)		-2.278***		-3.278***
Output Gap * Imports to GDP * IIT(20)			0.400	
Output Gap * Imports to GDP * IIT(70)				0.522
Output Gap * Imports to GDP	0.346	0.378		
Import price inflation	0.122***	0.125***	0.148***	0.175***
Observations	450	471	450	471
Number of cross sections	22	22	22	22

Note: Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. Imports to GDP is the ratio of total imports (goods and sevices) to GDP. Output gap * Imports to GDP is the product of the output gap and Imports to GDP. Output gap * IIT * Imports to GDP is the product of output gap, the intra-industry trade index and Imports to GDP. IIT(20) and IIT(70) is the Intra Industry Trade index measured with the Grubel Loyd method. In estimations 1 and 3, IIT(20) is computed with the STAN decomposition (20 industries). In estimations 2 and 4, IIT(70) is computed with the CHELEM decomposition (70 industries). All estimations include country dummies not reported. All estimations include a constant term. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Sargan test (not reported) always accepts the validity of instruments at 10%.

Table 4

Import price inflation pass-through to CPI inflation: the role of similarity between imports and domestic output.

Estimations	1	2	3	4	5	6	7
Dependent variable: **Annual CPI Inflation**	IV	IV	IV	IV	IV	IV	IV
Lagged CPI inflation	0.444***	0.552***	0.443***	0.412***	0.410***	0.393***	0.393***
Output Gap	0.329***	0.426***	0.325***	0.336***	0.337***	0.297***	0.298***
Import price inflation	0.053	-0.120*	0.050	0.045	0.019	-0.033	
Import price inflation * Imports to GDP	1.869***	1.604***	1.901***	1.851***	1.925***	1.689***	1.671***
Import price inflation * MPEN	-0.016***		-0.017***	-0.016***	-0.016**	-0.015***	-0.015***
Import price inflation * Imports to GDP* MPEN		-0.017***	0.002		-0.001		
Commodity Import Price Inflation				-0.019	-0.020		
Import price inflation * log (GDP per Capita)						0.076	0.075**
Import price inflation * log (GDP)						-0.020	-0.021**
Observations	386	386	386	380	380	386	386
Number of cross sections	20	20	20	19	19	20	20

Note: Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. Imports to GDP is the ratio of total imports (goods and sevices) to GDP. MPEN is the Import Penetration ratio. Import price inflation*Imports to GDP is the product of Import price inflation and Imports to GDP. Import price inflation*MPEN is the product of Import price inflation and Import Penetration ratio. Import price inflation*log(GDP) is the product of Import price inflation and log of GDP. Import price inflation*log(GDP per capita) is the product of Import price inflation and log of GDP per capita. All estimations include country dummies not reported. All estimations include a constant term. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Hausman test (not reported) always reject the null that OLS estimation is consistent. Sargan test (not reported) always accepts the validity of instruments at the 10% level.

Table 5

Globalization represented by IIT and/or imports to GDP

Estimations	1	2	3	4	5	6	7	8	9	10
Dependent variable: **Annual CPI Inflation**	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Lagged CPI inflation	0.549***	0.504***	0.486***	0.505***	0.518***	0.453***	0.507***	0.453***	0.480***	0.477***
Output Gap	0.390***	0.390***	0.376***	0.394***	0.381***	0.369***	0.372***	0.359***	0.393***	0.412**
Import price inflation	0.409***	0.349**	0.480***	0.430***	0.027	0.025	0.403***	0.343**	2.169***	2.309***
Import price inflation * Imports to GDP	0.222	0.266			1.395***	1.360***	0.217	0.295		
Import price inflation * IIT(20)	-0.602***		-0.652**				-0.652**		-0.445**	
Import price inflation * IIT(70)		-0.570**		-0.643**				-0.600**		-0.236**
Import price inflation * Imports to GDP* IIT(20)			0.363		-1.728***					
Import price inflation * Imports to GDP* IIT(70)				0.282		-1.802***				
Commodity Import Price Inflation							0.024	0.020		
Import price inflation * log (GDP per Capita)									-0.068	-0.046
Import price inflation * log (GDP)									-0.037*	-0.052**
Observations	450	471	450	471	428	471	428	471	428	471
Number of cross sections	22	23	23	23	23	23	23	23	23	23

Note: Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. Imports to GDP is the ratio of total imports (goods and sevices) to GDP. Import price inflation*Imports to GDP is the product of Import price inflation and Imports to GDP. IIT is the Intra Industry Trade index measured with the Grubel Loyd method. IIT(20) is computed with the STAN decomposition (20 industries), IIT(70) is computed with the CHELEM decomposition (70 industries). Import price inflation*IIT is the product of Import price inflation and intra-industry trade index. Import price inflation*Imports to GDP*IIT is the product of Import price inflation, Imports to GDP and IIT. Import price inflation*log(GDP per capita) is the product of Import price inflation and the log of GDP per capita. Import price inflation*log(GDP) is the product of Import price inflation and the log of GDP. All estimations include country dummies not reported. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Sargan test (not reported) always accepts the validity of instruments at the 10% level.

Table 6

Phillips Curve with GDP deflator

Estimations	1	2	3	4	5
Dependent variable: **Annual GDP deflator Inflation**	IV	IV	IV	IV	IV
Lagged GDP deflator inflation	0.715***	0.420*	0.710***	0.757***	0.786***
	(3.99)	(1.03)	(4.83)		
Output Gap	0.379***	0.272***	0.327***	2.105***	2.796***
	(3.73)	(7.03)	(5.65)		
Import price inflation	0.064	0.102**		0.112***	0.105***
	(1.14)	(2.22)			
Monetary Policy Credibility		-0.037	0.115**		
		(0.75)	(1.73)		
Import price inflation * Imports to GDP			0.091		
			(0.46)		
Output Gap * IIT				-0.029***	-0.035***
Observations	548	440	492	450	471
Number of cross sections	22	21	23	22	22

GDP deflator inflation is GDP deflator year on year growth. Lagged GDP deflator inflation is GDP deflator inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. Imports to GDP is the ratio of total imports (goods and sevices) to GDP. Import price inflation * Imports to GDP is the product of Import price inflation and Imports to GDP. IIT is the Intra Industry Trade index measured with the Grubel Loyd method with the STAN decomposition (20 industry-level). IIT_70 is computed with the Chelem decomposition (70 indutry-level). All estimations include country dummies not reported. All estimations include a constant term. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Hausman test carried out for IV estimations always reject the null that OLS estimation is consistent.

Table 7

Impact of IIT on the sensitivity of Inflation to domestic Output Gap

Estimations	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dependent variable: **Annual CPI Inflation**	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
Lagged CPI inflation	0.545***	0.369***	0.520***	0.332***	0.805***	0.763***	0.545***	0.573***	0.587***	0.554***	0.692***	0.654***	0.705***	0.870***
Output Gap	0.990***	0.997***	0.716***	0.761***	3.403**	0.266**	0.132***	1.019***	1.111***	1.366***	0.569	1.056***	0.750***	2.752**
Output Gap * IIT	-0.900*	-1.010***	-0.676**	-0.722**	-0.041**	-3.545**	-0.014**	-1.083***	-1.052***	-0.013**	-0.015**	-0.012**	-0.793**	-3.556**
Import price inflation	0.094***	0.094**	0.098***	0.101***	0.148***	0.094***	0.064**	0.076*	0.077*	0.065**	0.237**	0.083***	0.099**	0.141**
Output Gap * Monetary policy credibility	-0.229	-0.014	-0.098	-0.096										
Monetary policy credibility		-0.028**		-0.034***										
Output Gap * Capital Flows					-0.003	-0.003								
Output Gap * Reservation Wage							-0.005	-0.006						
Output Gap * EPL									-0.097*	-0.090**		-0.095**	-0.102*	
Output Gap * Low inflation environment											14.162***	4.038	4.0351	
Output Gap * Trade Balance														-9.125
Observations	401	401	420	420	424	444	408	408	408	408	446	426	406	406
Number of cross sections	21	21	21	21	21	21	20	20	20	20	21	21	20	20

Note: Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator (Imports to GDP is the ratio of total imports (goods and sevices) to GDP. Import price inflation * Imports to GDP is the product of Import price inflation and Imports to GDP. IIT is the Intra Industry T measured with the Grubel Loyd method (STAN industry decomposition). Monetary policy credibility is computed following the Laxton N'diaye method. Capital Flows is the ratio of gross private capit GDP. Reservation wage is an index of unemployment insurance benefit generosity (source: Allard 2003). EPL is an index of employment protection legislation (source: Allard 2003). Low inflation envi an moving average of past CPI inflation over the last three years. Trade balance is the ratio of net exports to GDP. All estimations include country dummies not reported. Absolute value of t s parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Sargan test(not reported) always accepts the null at the 10% level that instruments are valid.

Table 8

Withdrawing each countries of the sample

Estimations	1	2	3	4	5	6	7	8	9	10	11
Dependent variable: **Annual CPI Inflation**	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
country withdrawn	**AUS**	**AUT**	**BEL**	**CAN**	**CHE**	**DNK**	**ESP**	**FIN**	**FRA**	**GBR**	**GRC**
Lagged CPI inflation	0.540**	0.612***	0.630***	0.626***	0.617***	0.600***	0.632***	0.638***	0.621***	0.585***	0.564***
	(2.515)	*(2.885)*	*(2.885)*	*(2.972)*	*(2.880)*	*(2.947)*	*(2.950)*	*(2.867)*	*(2.883)*	*(2.850)*	*(2.827)*
output gap	2.299***	2.439**	2.485***	2.454***	2.415***	2.368***	2.499***	2.489***	2.470***	2.465***	2.292***
	(3.449)	*(3.520)*	*(3.520)*	*(3.605)*	*(3.523)*	*(3.686)*	*(3.607)*	*(3.482)*	*(3.543)*	*(3.588)*	*(3.743)*
output gap * IIT	-0.026***	-0.028**	-0.029***	-0.028***	-0.028***	-0.027***	-0.0297***	-0.028***	-0.029***	-0.030***	-0.026***
	(-2.757)	*(-2.862)*	*(-2.862)*	*(-2.852)*	*(-2.815)*	*(-2.908)*	*(-2.941)*	*(-2.793)*	*(-2.849)*	*(-2.927)*	*(-2.953)*
import price inflation	0.233*	0.220*	0.210*	0.206*	0.217*	0.221**	0.213*	0.204*	0.212*	0.230**	0.232**
	(1.883)	*(1.866)*	*(1.866)*	*(1.807)*	*(1.884)*	*(2.068)*	*(1.795)*	*(1.697)*	*(1.890)*	*(2.086)*	*(2.230)*

Estimations	12	13	14	15	16	17	18	19	20	21	22
Dependent variable: **Annual CPI Inflation**	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
country withdrawn	**IRL**	**ISL**	**ITA**	**JPN**	**LUX**	**NLD**	**NOR**	**NZL**	**PRT**	**SWE**	**USA**
Lagged CPI inflation	0.599***	0.466***	0.632***	0.624***	0.619***	0.634***	0.634***	0.808***	0.617***	0.602***	0.651***
	(2.710)	*(4.066)*	*(2.979)*	*(3.087)*	*(2.995)*	*(2.867)*	*(2.826)*	*(3.126)*	*(2.630)*	*(2.948)*	*(2.947)*
output gap	2.415***	0.938***	2.461***	2.681***	2.429***	2.514***	2.463***	2.960***	2.711***	2.366***	2.451***
	(3.432)	*(3.492)*	*(3.650)*	*(4.330)*	*(3.686)*	*(3.571)*	*(3.531)*	*(3.057)*	*(3.530)*	*(3.527)*	*(3.446)*
output gap * IIT	-2.794***	-0.011**	-0.029***	-0.031***	-0.028***	-0.029***	-0.028***	-0.034***	-0.031***	-0.027***	-0.028***
	(-0.028)	*(-2.493)*	*(-2.934)*	*(-3.446)*	*(-2.958)*	*(-2.840)*	*(-2.811)*	*(-2.593)*	*(-2.833)*	*(-2.779)*	*(-2.756)*
import price inflation	0.217*	0.121**	0.204*	0.264**	0.213*	0.203*	0.212*	0.130	0.182	0.227**	0.194
	(1.876)	*(2.074)*	*(1.819)*	*(2.558)*	*(1.947)*	*(1.712)*	*(1.820)*	*(0.940)*	*(1.407)*	*(2.091)*	*(1.608)*

Note: Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. IIT is Intra Industry Trade measured with the Grubel Loyd index. Output gap * IIT is the product of output gap and IIT. All estimations include country dummies not reported. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Sargan test (not reported) always accepts the validity of instruments.

Table 9

Withdrawing the first years of the sample period

Estimations	1	2	3	4	5	6
Dependent variable: **Annual CPI Inflation**	IV	IV	IV	IV	IV	IV
estimation period	**1984-2004**	**1985-2004**	**1986-2004**	**1987-2004**	**1988-2004**	**1989-2004**
Lagged CPI inflation	0.619***	0.308***	0.797***	0.624***	0.643***	0.484
	(2.995)	*(2.776)*	*(4.875)*	*(4.868)*	*(4.482)*	*(4.744)*
output gap	0.024***	0.931***	1.162***	0.899***	0.966***	1.101***
	(3.686)	*(3.239)*	*(4.618)*	*(4.756)*	*(5.961)*	*(4.722)*
output gap * IIT	-0.028***	-1.240**	-1.090***	-0.881***	-0.963***	-1.095***
	(-2.958)	*(-2.534)*	*(-2.939)*	*(-3.089)*	*(-3.454)*	*(-3.095)*
import price inflation	0.213*	-0.035	0.048	0.098	0.055	0.137*
	(1.947)	*(-0.237)*	*(0.531)*	*(1.313)*	*(0.482)*	*(1.940)*

Note: Lagged CPI inflation is CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. IIT is Intra Industry Trade measured with the Grubel Loyd index. All estimations include country dummies not reported. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Sargan test (not reported) always accepts the validity of instruments.

Table 10

Withdrawing the last years of the sample period

Estimations	1	2	3	4	5	6	7
Dependent variable: **Annual CPI Inflation**	IV	IV	IV	IV	IV	IV	IV
estimation period	**1984-2004**	**1984-2003**	**1984-2002**	**1984-2001**	**1984-2000**	**1984-1999**	**1984-1998**
Lagged CPI inflation	0.619***	0.597***	0.620***	0.615***	0.628***	0.600***	0.616**
	(2.995)	*(2.899)*	*(2.851)*	*(2.806)*	*(2.688)*	*(2.530)*	*(2.540)*
output gap	0.024***	0.024***	0.025***	0.026***	0.026***	0.025***	0.026***
	(3.686)	*(3.666)*	*(3.550)*	*(3.667)*	*(3.512)*	*(3.361)*	*(3.349)*
output gap * IIT	-0.028***	-0.028***	-0.029***	-0.031***	-0.030***	-0.029***	-0.030***
	(-2.958)	*(-2.951)*	*(-2.847)*	*(-3.015)*	*(-2.862)*	*(-2.724)*	*(-2.663)*
import price inflation	0.213*	0.222**	0.198*	0.196	0.192	0.213	0.206
	(1.947)	*(2.021)*	*(1.661)*	*(1.585)*	*(1.469)*	*(1.642)*	*(1.558)*

Note: Lagged CPI inflation is annual CPI inflation one year before. Output Gap is the difference between log of GDP and HP filter of log of GDP. Import price inflation is the annual growth rate of the deflator of imports. IIT is Intra Industry Trade measured with the Grubel Loyd index. All estimations include country dummies not reported. Absolute value of t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Sargan test (not reported) always accepts the validity of instruments.