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Résumé – Dans cet article, nous nous appuyons sur des relevés de prix microéconomiques et des indices sectoriels d'inflation pour ré-examiner la relation entre la rigidité des prix et la persistance de l'inflation. Récemment Bils et Klenow (2004) ont mis en avant l'absence de corrélation, en coupe sectorielle, entre ces deux variables, et l'ont interprétée comme une invalidation des modèles de fixation des prix "time dependent" à la Calvo. Nous montrons cependant que, si l'on purge les données des chocs sectoriels en suivant l'approche de Boivin, Gianoni et Mihov (2009), et si l'on emploie une hypothèse moins restrictive quant au processus suivi par le coût marginal, le diagnostic négatif sur la pertinence des modèles de rigidité dépendant du temps à la Calvo est considérablement affaibli.

Mots clés : Rigidité des prix, Hétérogénéité, Persistance de l'inflation.

Codes JEL : E31, E32.

Abstract – In this paper, using US as well as French sectoral data and indicators of price rigidity, we re-examine the (lack of) relation between price stickiness and inflation persistence. This has recently been put forward by Bils and Klenow (2004) as evidence against time-dependent price setting models. We obtain that, when filtering out sector-specific shocks along the lines of Boivin, Giannoni, and Mihov (2009), and allowing for an alternative assumption on the marginal cost process, the case against the time-dependent Calvo model is substantially weakened.

Keywords: Sticky prices, Heterogeneity, Inflation persistence.

JEL classification: E31, E32.

1. Introduction

In an influential paper, Bils and Klenow (2004) have made two key contributions to the macroeconomic literature on sticky price models. First, they report comprehensive evidence on price stickiness at a very disaggregated microeconomic level. Most of the subsequent macroeconomic literature has focused on this evidence on frequencies of price change to calibrate or assess sticky price models. Second, they document that no clear–cut relation between price stickiness and sectoral inflation persistence emerges from US data. The latter result has received much less attention. However, it potentially raises a serious challenge for the sticky price models underlying the New Keynesian Phillips Curve. In particular, as Bils and Klenow (2004) argue, taken at face value, a model of price stickiness such as that proposed by Calvo (1983) is inconsistent with the low inflation persistence observed in sectoral data.

In this paper, using both US and French sectoral data, we revisit the (in)ability of a Calvo (1983) model to match the relationship between price rigidity and sectoral inflation persistence. As Bils and Klenow, we observe for both countries that, given the degree of price rigidity, inflation persistence observed in monthly sectoral inflation is inconsistent with that predicted by the Calvo pricing model, under the assumption of a random-walk behavior for marginal cost. We then consider two alterations to their approach. First, we filter out idiosyncratic shocks from sectoral inflation rates along the lines of Boivin, Giannoni, and Mihov (2009) using a factor analysis. The rationale for such an approach is that the Calvo model arguably only aims at characterizing response to macroeconomic shocks. In the US case, we use the same data as Boivin, Giannoni, and Mihov (2009), except that we replace their sectoral price data with those of Bils and Klenow (2004). In the French case we collect a large dataset of over 380 monthly series and proceed to the same analysis. Second, we depart from the process assumed by Bils and Klenow for the marginal cost. We do so by simulating a multi–sector sticky price model featuring heterogeneous sectors with frequencies of price change calibrated to the observed microeconomic degrees of price stickiness. The model is subject to aggregate shocks only, which we either back out from a VAR model or calibrate to match the persistence and volatility of aggregate inflation. Our main finding is that under these two alterations, results appear to be much more supportive of the Calvo (1983) model than with the baseline approach of Bils and Klenow (2004). We underline that, aside from this model-based analysis, a contribution of the paper is to document, following Bils and Klenow's approach, the empirical relation between inflation persistence and price stickiness for France, based on a unique microeconomic dataset consisting of the individual consumer price quotes used for the computation of the French Consumer Price Index (CPI). To our knowledge, this relation has not been investigated for other countries than the US so far.

The remainder is as follows. Section 2 describes the French data and provides a set of descriptive statistics on the frequency of price changes and sectoral inflation persistence. Section 3 then proposes a multi–sector model which we simulate either under Bils and Klenow's (2004) assumption of a random–walk behavior for all nominal marginal costs or with our alternative approach. The last section briefly concludes.

2. Price stickiness and inflation persistence : Sectoral evidence

In this section, we document the empirical relation between sectoral inflation and price stickiness in France and the US, using the Bils and Klenow (2004) methodology. In the US case, our analysis is mainly a replication of their findings, which we complement by an analysis of inflation persistence conditional to macroeconomic shocks, along the lines of Boivin, Giannoni, and Mihov (2009).

2.1. **The data.** In the US case, we use the indicators of price rigidity produced by Bils and Klenow (2004) at the product level category as well as the sectoral inflation indices and their CPI weights.[1] The number of product categories included in the analysis is 123. In their benchmark analysis, Bils and Klenow (2004) use micro data for three years only (1995 to 1997) to compute the frequencies of price changes. To compute sectoral inflation persistence, they use two alternative samples: 1959(1):2000(6) and 1995(1):2000(6). While these samples do not match those used to compute frequencies of price changes, longer samples are required to obtain more reliable estimates of persistence. For the purpose of this paper, we select an intermediate sample (1991(1):2000(6)). This choice reflects a trade-off between, on the one hand, the objective of reaching a sufficient sample size, and on the other hand, the objective of minimizing discrepancy with the sample period of the micro data. Following Bils and Klenow (2004), for the sake of internal consistency, we also compute and use a monthly aggregate inflation rate obtained by aggregating the sectoral inflation rates using their CPI weights.

In the French case, we use monthly indicators of price rigidity constructed from individual price records collected by INSEE (Institut National de la Statistique et des Etudes Economiques) for the computation of the French CPI. The large (around 13 millions price observations) dataset used here contains monthly price records, from July 1994 to February 2003. These data cover around 65% of the total weight of the CPI. Individual price data for fresh foods, rents, purchases of cars, and administered prices (during the sample period) such as electricity or telephone are not included in the dataset.

With each individual record some meta-data are available which allow us to track an individual product over time and to identify the sector and special events affecting it (indicating whether the price record is a regular one, a sales price, an "imputed" price due to stockout, etc.). The data was processed to produce the final database used in our analysis. For instance, we replace any unobserved price by the previous price observed for the same item over the preceding period. Also, prices being set in euros from 2002(1) onwards, we also take the Euro cash change-over into account. See Baudry, Le Bihan, Sevestre, and Tarrieu (2007) for details and basic results. At the 5-level digit of the COICOP[2] nomenclature, this dataset finally allows us to compute sectoral frequencies of price changes for 136 sectors. These frequencies are denoted by λ_i in the remainder, i being the sector index.

We match these data with a dataset of sectoral consumer price indices, i.e. price indices for the 136 available sectors. These data have been used by Bilke (2005) and we resort to the same back-casting procedure as his. We further discard some sectors. First, to obtain a balanced sample we drop series that are not present over the full sample. We have selected the sample period (1991(1):2008(9)), again to reach a balance between the objective of consistency with the sample period of micro data, and that of having a long enough sample to consistently estimate persistence and common factors. Second, we drop series affected by a major methodological break undertaken at INSEE: prior to 1998, prices for some durable goods were only collected at a quarterly frequency; after 1998, they are collected at a monthly frequency. This break mechanically produces spurious results when estimating autoregressive (AR) processes. After getting rid of these goods, we end up studying a number of $N = 110$ sectors. Notice that price indices are produced by the Statistical Institute from the exact same set of micro price records, entailing full consistency. One advantage of this dataset over the US dataset analyzed by Bils and Klenow, is that the period over which micro data are available are longer, resulting in a better consistency with indicators of inflation persistence. Finally, as Bils and Klenow (2004) for the US, we build a monthly aggregate inflation rate by aggregating the $N = 110$ inflation rates, each sectoral inflation rate being given the same weight as in the actual computation of the French CPI. This aggregate inflation rate is close to the headline inflation rate, and will be used throughout the paper.

To filter out idiosyncratic shocks from the data, we follow the approach of Boivin, Giannoni, and Mihov (2009) and estimate factors from a wide set of monthly macroeconomic indicators. For that purpose, in the US case, we use the precise dataset of Boivin, Giannoni, and Mihov (2009) and refer to their article and online appendix for a description. One exception is that, for consistency purpose, we substitute the 190 indices of Personal Consumption Expenditure Deflator of Boivin, Giannoni, and Mihov (2009) with the 136 CPI indices of Bils and Klenow (2004). Overall, we use 585 series. For France we collected a range of available monthly series over the period 1991(1):2008(9) mainly related to output, employment, business surveys, exchange rate, interest rates, monetary indicators, producer, and consumer prices. We end up with a set of 381 series. These series are described in an available appendix. They were transformed to induce stationarity following the same rules as Boivin, Giannoni, and Mihov (2009).[3]

2.2. **Empirical results.** We first replicate the results found by Bils and Klenow (2004) on US data, and investigate whether French microeconomic data on price records exhibit similar characteristics. We start our empirical analysis by providing a set of summary statistics on sectoral inflation persistence and sectoral frequencies of price change. In practice, we use the first order serial correlation of monthly sectoral inflation rates as our baseline measure of inflation persistence, which we denote by ρ_i. Arguably, this might be a restrictive approach to measuring persistence. Thus, we alternatively consider a higher–order AR process for sectoral inflation persistence.

To be more specific, we use standard information criteria to determine the AR order on aggregate inflation, here $k = 5$, and use this model as an alternative to the AR(1) model for all sectors. In this case, our persistence measure is the sum of AR coefficients.[4]

The empirical analysis is conducted in two steps. First, we use raw sectoral price data, in the same spirit as Bils and Klenow (2004). Second, we follow Boivin, Giannoni, and Mihov (2009) and filter sectoral price data to eliminate their idiosyncratic components. To do this, we resort to a large set of macroeconomic and sectoral series X_t, including sectoral inflation data, and extract common factors from these data. Specifically, as in Boivin, Giannoni, and Mihov (2009), we assume that X_t is governed by 5 common factors f_t, and estimate the factors performing a principal component analysis . Each sectoral inflation rate $\pi_{i,t}$ can thus be decomposed according to

$$\pi_{i,t} = \mu_i f_t + e_{i,t},$$

where μ_i are the sectoral loadings and $e_{i,t}$ is the idiosyncratic component of sector i's inflation rate. The filtered inflation rates $\tilde{\pi}_{i,t}$ are then simply defined as

$$\tilde{\pi}_{i,t} = \pi_{i,t} - e_{i,t}.$$

Table 1 reports some descriptive statistics on sectoral price stickiness λ_i and inflation persistence ρ_i (either unconditional or conditional on common shocks only) across $N = 110$ categories of goods for French data and the $N = 123$ categories for US data. Recall that, here, λ_i is the frequency of price changes in sector i, as estimated in Bils and Klenow (2004) for the US and in Baudry, Le Bihan, Sevestre, and Tarrieu (2007) for France.

Several striking facts emerge from this table. First, consumer prices are rather sticky, especially so in France, since the mean frequency of price changes across sectors is 19.5% per month for France and 26.4% in the US. At the same time, the amount of heterogeneity in price stickiness is massive, since the cross–section standard error of frequencies of price changes is 18.7 percentage points in France and 18.6 in the US.

Second, when focussing on the AR(1) specification, the degree of aggregate inflation persistence is rather low ($\rho = 0.12$ in the US or $\rho = 0.34$ for France). While a low degree of aggregate inflation persistence is not a standard empirical result, notice that in our sample, both for France and for the US, the large disinflation episodes of the 1980's are excluded. Although there is some controversy in the literature (see e.g. Batini, 2006, Benati, 2008, Levin and Piger, 2003, O'Reilly and Whelan, 2005), there is evidence that estimated persistence is much lower when the data are restricted to a stable post-disinflation policy regime than when these episodes are included in the sample. Sectoral inflation persistence are even lower than aggregate persistence, since the mean ρ_i is 0.02 in the US and 0.22 in France. It is fairly standard to observe low persistence at the sectoral level, due to the importance of transient shocks. Low sectoral inflation persistence need not be inconsistent with higher aggregate inflation persistence, as it is known, at least since Granger (1980), that aggregation tends to raise the overall level of persistence. For the AR(5) specification, we obtain broadly similar results, except that the aggregate inflation persistence seems higher in the US than in France.

Third, the correlation between inflation persistence and price flexibility is counter–intuitively positive for both countries, though not significantly. This stands in contrast with a regular empirical finding in the New Keynesian literature that a very high degree of price stickiness is needed to match the degree of persistence in aggregate inflation.[5] Nothing like this, however, seems to emerge from our disaggregate dataset. At the same time, the correlation between the volatility of the innovation and the flexibility of prices is positive, which, as argued by Bils and Klenow (2004), is consistent with time dependent sticky price models.[6] These results obtain whether inflation persistence is measured from an AR(1) or from an AR(5) model.

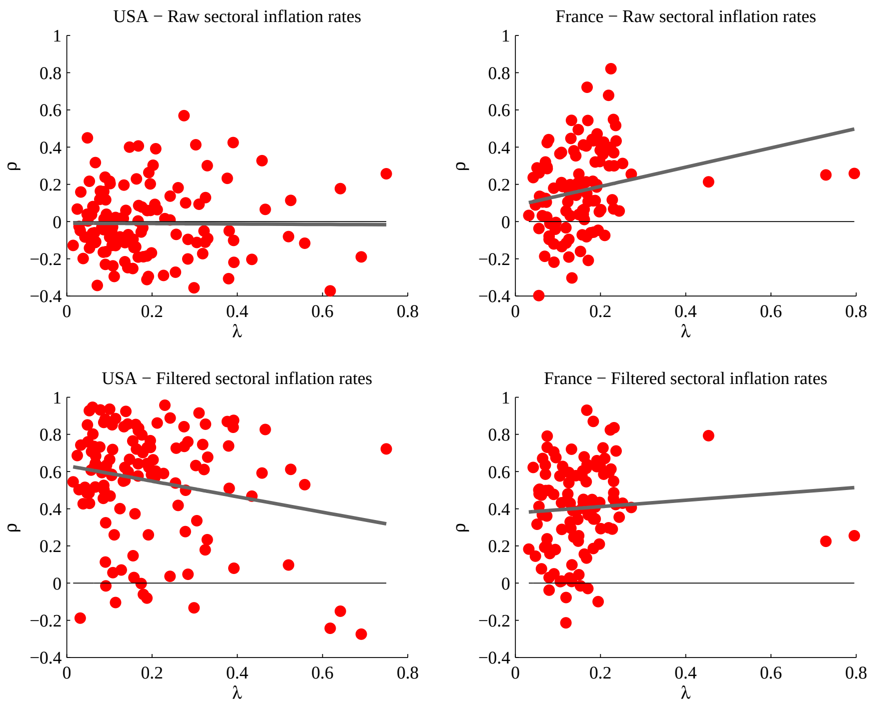
Several sources of measurement error and biases (in particular the small-sample bias of least-squares in AR models or misspecification biases) can potentially explain the apparently low serial correlation of sectoral inflation rates. We have examined these biases and argue that none are convincing candidates and that unfiltered sectoral inflation rates indeed posses low or even negative persistence.[7] It is in addition important to note that, in next section's model–based investigations, misspecification biases are controlled for. Indeed in the spirit of, e.g. Cogley and Nason (1995) and Sims (1989), we treat the model and data symmetrically. More specifically, we use simulations to produce finite-sample versions of the relation between persistence and price rigidity generated by each model we consider.[8] As a consequence, biases in the moments or in the reduced form we investigate will not be driving our assessment of the model.

Table 1. Summary Statistics on the Relation Price Stickiness–Persistence

	USA				France			
Mean λ_i	0.264 (0.017)				0.195 (0.018)			
S.E. λ_i	0.186 (0.023)				0.187 (0.030)			
	Raw Data		Filtered Data		Raw Data		Filtered Data	
	AR(1)	AR(5)	AR(1)	AR(5)	AR(1)	AR(5)	AR(1)	AR(5)
ρ	0.124 (0.095)	0.263 (0.201)			0.340 (0.067)	0.246 (0.123)		
σ_ϵ	0.200	0.193			0.203	0.203		
Mean ρ_i	0.021 (0.020)	−0.023 (0.046)	0.641 (0.026)	0.791 (0.024)	0.220 (0.020)	0.250 (0.045)	0.431 (0.022)	0.675 (0.025)
Mean $\sigma_{\epsilon,i}$	0.814 (0.076)	0.777 (0.072)	0.173 (0.006)	0.153 (0.005)	0.592 (0.084)	0.572 (0.079)	0.363 (0.016)	0.336 (0.015)
corr(λ_i, ρ_i)	0.077 (0.091)	−0.079 (0.091)	−0.292 (0.087)	−0.376 (0.084)	0.135 (0.095)	−0.039 (0.096)	−0.166 (0.095)	−0.179 (0.095)
corr$(\lambda_i, \sigma_{\epsilon,i})$	0.637 (0.070)	0.636 (0.070)	0.046 (0.091)	0.021 (0.091)	0.535 (0.081)	0.569 (0.079)	−0.361 (0.090)	−0.331 (0.091)

Note: S.E. λ_i is the standard error in the cross-section dimension of the λ_i's. Standard errors for estimated parameters are reported in parentheses. For instance the cross–section standard deviation of λ_i for France is $\sqrt{\sum \omega_i(\lambda_i - \bar{\lambda})^2} = 0.187$, so that for $N = 110$, the standard error of the sample mean (Mean λ_i) is $0.187/\sqrt{N} = 0.018$. The standard error of S.E. λ_i is estimated according to the formula reported in Greene (1997), p. 129. Aggregate inflation persistence (ρ) and sectoral persistences (ρ_i) are measured by the sum of AR parameters from autoregressions. In the AR(1) case the autoregression is $\pi_t = \alpha + \rho\pi_{t-1} + \varepsilon_t$ with $\sigma_\varepsilon = \mathrm{E}\{\varepsilon_t^2\}$.

Figure 1. Empirical relation between price stickiness and inflation persistence



Notes: λ is the estimated probability of price change and ρ is first order serial correlation coefficient. The red dots correspond to the empirical observations. The grey lines are simple regression lines.

The analysis conducted by Boivin, Giannoni, and Mihov (2009) provides a much more convincing explanation of the observed low degree of persistence of sectoral inflation rates. They argue that these series are actually dominated by sector–specific shocks that need not be correlated with macroeconomic perturbations. From a macroeconomic perspective, these idiosyncratic inflation components are arguably less interesting. To investigate this further, we thus perform a similar principal component analysis as Boivin, Giannoni, and Mihov (2009) and compute our summary statistics on filtered data.

Resorting to filtered sectoral price data changes the picture dramatically. First, mean sectoral inflation persistence is much higher (0.64 in the US and 0.43 in France). This confirms results highlighted by Boivin, Giannoni, and Mihov (2009) using a different sectoral price dataset. Second, the correlation between inflation persistence and price flexibility is uncontroversially negative and significant (-0.29 in the US and -0.17 in France).[9]

Figure 1 gives a visual illustration of our results. The figure reports scatter plots of λ_i's and ρ_i's. The upper panels of the figure use persistence measures based on raw sectoral inflation rates, while in the lower ones inflation rates filtered using common components are used. The scatter plots on the left column relate to the US. The figure in the upper-left is thus nearly a replication of the graph originally produced by Bils and Klenow (2004), the small differences in the results owing to a marginally different sample for estimating persistence. In spite of structural differences between the US and France, the upper-right panel indicates that results on French data are in line with those obtained for the US. In these benchmark pictures, we use the AR(1) model to compute the ρ_i's. A similar pattern (unreported to save space) emerges from the alternative specification with an AR(5) model.

The bottom line of those figures is the absence of a simple cross-section relation between inflation persistence and price stickiness when raw data are used. In other words, a high sectoral inflation persistence is not necessarily an immediate consequence of a high degree of price stickiness (i.e. a low frequency of price change, λ). Clearly, in either the US or in the French cases, there are instances where a low λ is associated with a low or even negative serial correlation of inflation persistence. At the same time, some sectors appear to be very flexible (high λ) and yet exhibit a positive degree of inflation persistence.

Once again, using filtered data changes these conclusions in a significant manner. Basically, all the points are located at higher positions along the ρ–axis. This is a clear–cut visual confirmation of the summary statistics reported in Table 1. This is particularly striking when it comes to the US. In this case, in addition, a negatively–sloped relation seems to emerge while no such conclusion could be drawn using unfiltered data.

3. Interpreting the evidence

In this section, we use the above samples of frequencies of price changes to calibrate a multisector model with sticky prices under two alternative sets of assumptions regarding the dynamic behavior of marginal costs. In the first set, we adopt the assumptions discussed in Bils and Klenow (2004). In the second one, we relax part of these and adopt a slightly more flexible approach. The main purpose is to investigate whether a version of the Calvo (1983) model embedding a limited degree of heterogeneity can conform with the empirical evidence discussed above.

3.1. **A multi–sector framework.** We consider a multi–sector economy with as many products as CPI items in the US or French dataset. The model is closely linked to that studied by Carvalho (2006). There are N consumer products, which consumers combine according to a weighted CES utility function displaying the standard "taste for variety" feature

$$C_t = \left(\sum_{i=1}^{N} \omega_i^{1/\theta} C_{i,t}^{(\theta-1)/\theta} \right)^{\theta/(\theta-1)}.$$

Here, θ is the elasticity of substitution between consumption goods and ω_i is the relative weight of good i in the CES basket, which corresponds to the weight given to good i in the CPI price index.

In each sector i, the consumption good i is itself produced by perfectly competitive firms which combine a continuum of sector–specific intermediate goods according to

$$C_{i,t} = \omega_i \left(\int_0^1 C_{i,t}(j)^{(\theta-1)/\theta} \mathrm{d}j \right)^{\theta/(\theta-1)} .$$

Notice that to simplify the model, as in Carvalho (2006), we assume that the elasticity of substitution between any two intermediate goods in sector i is the same as that between any two consumption goods in the first CES basket.

In turn, each intermediate good (i, j) is produced by a monopolistically competitive firm, according to the simple production function

$$C_{i,t}(j) = F(N_{i,t}(j), Z_t)$$

where $N_{i,t}(j)$ denotes the labor input and $F(\cdot)$ is a standard production function, where Z_t is a vector of relevant variables other than labor. Each intermediate firm j in sector i sets its price according to a Calvo (1983) process, λ_i being the constant probability that price reoptimization is allowed in the current period.

3.2. **The Bils–Klenow hypothesis.** As shown by Bils and Klenow (2004), drawing on previous results (e.g. Galí and Gertler, 1999), the price $x_{i,t}$ chosen by any firm allowed to reoptimize at t in sector i, in logdeviation from a zero inflation steady state, obeys the relation

$$x_{i,t} = (1 - \beta(1 - \lambda_i))\mathrm{E}_t \sum_{k=0}^{\infty} [\beta(1 - \lambda_i)]^k s_{i,t+k}, \tag{1}$$

where $s_{i,t}$ is the logdeviation of the nominal marginal cost in sector i. Here, E_t is the conditional expectation operator, and β is the subjective discount factor. In addition, the Calvo (1983) model implies

$$p_{i,t} = \lambda_i x_{i,t} + (1 - \lambda_i)p_{i,t-1}, \tag{2}$$

where $p_{i,t}$ is the logdeviation of sector i's aggregate good price from a zero inflation steady state.

Based on some empirical evidence for US manufacturing industries, Bils and Klenow (2004) argue that $s_{i,t}$ is close to a random walk. To be more specific, we follow their lead and assume that

$$s_{i,t} = s_{i,t-1} + \epsilon_{i,t}, \quad \epsilon_{i,t} \sim iid(0, \sigma_i^2). \tag{3}$$

As a consequence, $\mathrm{E}_t s_{i,t+k} = s_{i,t}$, and solving (1) forward yields $x_{i,t} = s_{i,t}$. Plugging this in (2) implies

$$\pi_{i,t} = (1 - \lambda_i)\pi_{i,t-1} + \lambda_i \epsilon_{i,t}, \tag{4}$$

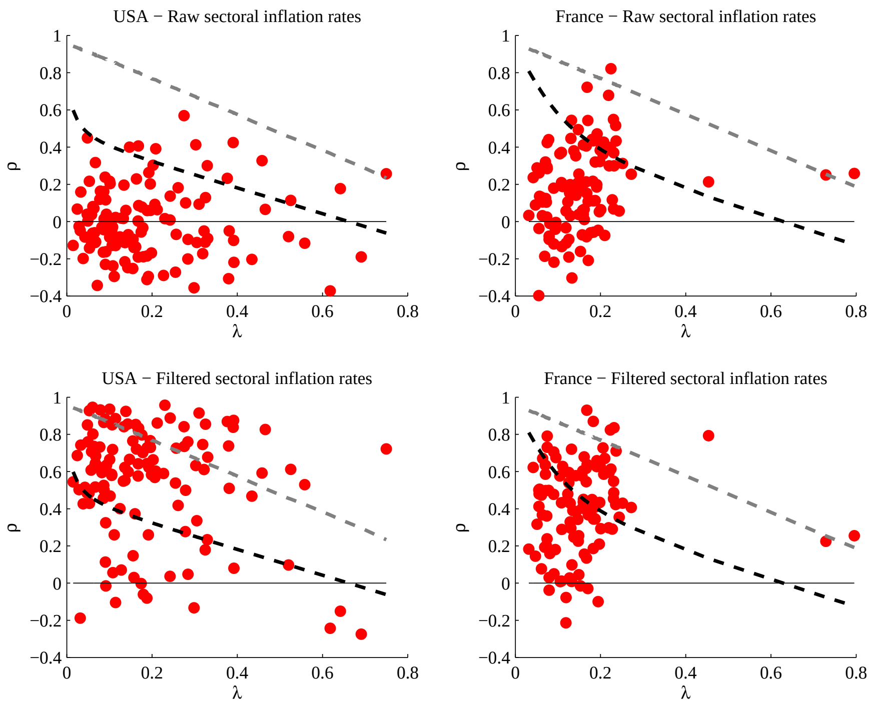
where $\pi_{i,t} \equiv p_{i,t} - p_{i,t-1}$. Thus, price inflation in sector i follows a simple AR(1) model with serial correlation coefficient $1 - \lambda_i$. It follows from this that the serial correlation of individual price inflation and the probability of price change in the Calvo model are perfectly negatively correlated.

We then simulate the model to generate a theoretical counterpart to the empirical sample of ρ's. In doing so, we must make sure that we use the exact same empirical procedure to compute ρ as in the previous section. Failing to do so would lead us to inadequately compare small–sample estimates of ρ from the data with asymptotic (population) degrees of serial correlation from the model. This is very much in the spirit of the procedure advocated by Sims (1989) and Cogley and Nason (1995). The small–sample estimates of ρ's simulated from the model are obtained as follows. For each value of λ_i from a fine grid, we use equation (4) to generate $S = 2000$ samples of the exact same size as our data (for each simulation, we actually simulated 200 "pre-sample" observations as an initialization sample, that are subsequently removed before performing computations to minimize the effects of initial conditions). For each sample an AR(1) model is estimated. Finally, the reported ρ is the mean across Monte Carlo simulations of the simulated AR(1) coefficients. Notice that we run into a potentially serious difficulty when implementing this procedure: since we have no data on marginal costs for France, the standard error of $\epsilon_{i,t}$, which is a nuisance parameter, is unknown. Fortunately, as shown by Bao (2007), the contribution of the standard error of $\epsilon_{i,t}$ to the OLS bias for ρ is of order T^{-2}, where T is the sample size.[10] As a matter of fact, the curve produced through small-sample simulations closely resembles the population curve that would emerge from the tight theoretical link between λ and ρ under the assumption of a random walk in nominal marginal costs. This is not surprising a result, since as argued before, the small–sample bias when estimating ρ is small, except for very large degrees of serial correlation.

The small–sample counterpart of relation (4) is reported in Figure 2 together with the previous scatter plots for the US and the French cases. The thin, gray line corresponds to the model–based relationship linking inflation persistence with price stickiness. Again, the upper panels report persistence computed with raw data while lower panels report them using filtered data.

As previously emphasized by Bils and Klenow (2004), this theoretical relationship does not even remotely match the (lack of) pattern in the empirical link between the ρ's and the λ's obtained with raw sectoral inflation data. Also, as seen from the upper-right panel, the failure of a multisector version of the Calvo (1983) similarly holds in the French case. Taken at face value, this would constitute strong evidence against this model. However, when we consider the plots with filtered sectoral inflation data instead, we obtain much more encouraging results. In the US case, the gray line runs through the empirical

Figure 2. Theoretical relation between price stickiness and inflation persistence



observations. In the French case, however, the assumption of nominal marginal costs following a random–walk still fails to provide an accurate description of the data even after removing the idiosyncratic components of sectoral inflation data.

There is potentially a problem with the above assumption of a random walk behavior of sectoral, nominal marginal costs. Indeed, the series of sectoral marginal cost data used by Bils and Klenow (2004) to support the random walk assumption in the US case correspond only imperfectly with the sectors for which microeconomic data on price changes are available. It is thus unclear whether the results reported above constitute a decisive critique against the Calvo (1983) model of nominal price adjustment. For the French case, the assumption of a random walk behavior of sectoral, nominal marginal costs raises an additional problem. Indeed, no such marginal cost data at this level of disaggregation are available. It is thus impossible to assess the plausibility of this assumption in the present case. In addition the assumption of a random walk in the nominal marginal cost is debatable on theoretical grounds.

In an attempt to circumvent these problems, the next subsection adopts a different set of assumptions in order to run a similar quantitative exercise. The basic idea is to adopt additional theoretical assumptions that enable us to disregard marginal cost data.

3.3. **An alternative assumption on marginal costs.** We assume the same preference and market structure as in Carvalho (2006). Specifically, the production function $F(\cdot)$ is assumed to be linear. This results in a set of N loglinearized price equations

$$x_{i,t} = (1 - \beta(1 - \lambda_i))\mathrm{E}_t \sum_{k=0}^{\infty} [\beta(1 - \lambda_i)]^k (p_{t+k} + \eta y_{t+k}) + u_t, \tag{5}$$

where y_t is aggregate output, η is a synthetic parameter, combining deep parameters relating to preferences and technology (see, e.g. Woodford, 2003, chapter 3), and u_t is an economy–wide cost–push shock, evolving according to the AR(1) process $u_t = \rho_u u_{t-1} + \sigma_u \epsilon_{u,t}$, $\epsilon_{u,t} \sim iid(0, 1)$. The presence of this cost push shock could be rationalized by assuming that θ is subject to random shifts translating into stochastic variations in the markup charged by monopolistic firms.

Notice that implicit in our above setup is the assumption of a labor market wherein firms are price takers. As shown in Woodford (2003), this assumption allows for a simple relation between aggregate output and the economy–wide real marginal cost. This simple relation is summarized by the synthetic parameter η. Notice that this market need not be an economy–wide market, as argued by Woodford (2003). As a matter of fact, allowing for an industry–specific labor market greatly helps one–sector sticky prices models to match aggregate inflation persistence.

The aggregate price index, p_t, is linked to individual prices according to the relation

$$p_t = \sum_{i=1}^{N} \omega_i p_{i,t}. \tag{6}$$

To close the model, one of two choices is available to us. First, we could specify market arrangements and a preference structure defining the willingness of agents to supply labor. Second, we could rely on a reduced–form model specifying the stochastic behavior of aggregate output y_t. Given that our focus is mainly descriptive and that we refrain from drawing policy recommendations from our analysis, we settle for the second option.

To do so, we specify a monthly VAR model for the joint process of output, the 3–months nominal interest rate, and aggregate consumer price inflation (in this order) using data covering the period 1991(1)–2000(6) for the US and 1991(1)-2008(9) for France. Monthly output is obtained from quarterly GDP using the time disaggregation procedure proposed by Chow and Lin (1971) and relying on industrial production as the regression covariate. We then compute an output gap series by linearly detrending the logarithm of the series. Importantly, we here too use the aggregate inflation measure consistent with our sectoral price indices. Based on a likelihood–ratio test, we adopt a 1-lag structure for the US case and an 2-lag structure for France. Using a standard Cholesky orthogonalization, we constrain output to react on impact to its own shock; inflation, in contrast, reacts to all shocks. This identification scheme is consistent with equation (5).

In a second step, in the spirit of Fuhrer and Moore (1995) and Coenen, Levin, and Christoffel (2007), we design a multivariate model as follows. First, the auxiliary output and interest rate equations from the VAR are fed into the multi–sector model, using orthogonalized shocks as the driving forces, after having eliminated the inflation equation from the VAR. Second, to define aggregate inflation in terms of the multi–sector model variables, we use the simple identity $\pi_t \equiv p_t - p_{t-1}$. The overall model thus comprises these three equations together with the N forward-looking equations (5), N equations defining the sectoral price level as well as equation (6), and the equation for the cost push shock. This large linear rational expectation model is solved using the AIM procedure (Anderson and Moore, 1985).[11]

Armed with the above framework, we then propose the following quantitative experiment. First, each of the N vectors $(\lambda_i, \omega_i)_{i=1}^{N}$ is calibrated to match exactly their empirical counterpart from the preceding section, taken from Baudry, Le Bihan, Sevestre, and Tarrieu (2007) for France and Bils and Klenow (2004) for the US. Following Carvalho (2006) calibration we set β to 0.9975 and η to 0.13. We then calibrate ρ_u and σ_u to match exactly the volatility and persistence of aggregate inflation, given the theoretical setup adopted here.[12]

To derive the model-based counterpart of the empirical relation between λ and ρ, we proceed as in the previous section. We use the calibrated model as our data generating process and generate $S = 2000$ samples of the exact same size as in the actual data (again, to attenuate the influence of initial observations, a set of 200 "pre-sample" observations was simulated, without being used in estimation). For each simulation, we estimate sectoral ρ's by least–squares. For each sector, our final theoretical counterpart of inflation persistence is the average across simulations of the S estimated AR(1) coefficients. This procedure produces a sample of cross-sectional observations of persistence for each of the N individual price inflation rates generated by the model. These are plotted against the λ's in order to generate a theoretical counterpart of Bils and Klenow's (2004) curve, under a slightly different assumption regarding the dynamic behavior of marginal costs.

The results are reported in Figure 2, in which the black, dashed line corresponds to the non–linear relationship between inflation persistence and price stickiness obtained under our alternative assumptions. Upon inspecting this figure, it is clear that *(i)* the curve linking the ρ's and the λ's is much lower than that obtained under the Bils and Klenow (2004) assumption and *(ii)* this curve is not a straight line and, in particular, appears to be convex in the low λ region of the graphs. In either the US or in the French case, the theoretical curve captures more points in the scatter plot than that in the Bils and Klenow (2004) model. In addition, both for the US and France, the model is able to generate negative serial correlation in sectoral inflation. However, this happens only in the high λ region of Figure 2, while empirically, with unfiltered data, this obtains for the most part in the low λ region, i.e. in those sectors with the highest degree of price rigidity (see the top panels of Figure 2). Thus, even if our alternative assumption regarding the marginal cost helps reconcile the Calvo (1983) model with empirical data, it still falls short from providing a completely satisfying description.

As before, this failure might reflect the prevalence of sector–specific shocks that actually dominate the dynamics of sectoral inflation rates, as argued by Boivin, Giannoni, and Mihov (2009). To investigate this issue in further details, we compare this theoretical curve with persistence indicators estimated from the filtered sectoral inflation data (see the bottom panels of Figure 2). In the case of French data (reported in the lower left Panel of the figure), the theoretical curve crosses the data scatter plot right-through the middle. Thus using jointly our two alterations to the Bils and Klenow approach substantially weakens the case against the Calvo model. In the case of the US (reported in the lower–right panel of the figure) the model–generated curve crosses the scatter plot in its lower part. Thus jointly implementing these two alterations in some sense seems to go too far: indeed our model here underpredicts persistence, conditional on common shocks, in sectoral inflation.

4. Concluding remarks

Our main results are the following. First, no simple empirical relationship exists between price rigidity and the degree of (unconditional) sectoral inflation persistence, a finding reported by Bils and Klenow (2004) for the US that we as well obtain for France. Bils and Klenow (2004) interpreted this result as evidence against the Calvo time-dependent pricing model, which over-predicts inflation persistence. We however show that allowing for two mechanisms goes a long way toward reconciling the Calvo model with evidence on sectoral inflation persistence. First, filtering the inflation rates to remove idiosyncratic components along the lines of Boivin, Giannoni, and Mihov (2009). Second, altering the marginal cost process, so as to allow a minimal degree of feedback from the inflation rate to the marginal cost. The first mechanism works toward increasing persistence and gives rise in our data to a negative correlation between inflation persistence and the frequency of price changes. The second mechanism decreases the model predicted persistence.

One avenue for future research would involve using actual sectoral marginal cost data in a multisector model with explicit idiosyncratic shocks. Whether such a model is able to replicate the (lack of) persistence in the raw inflation rates would provide a more stringent test of the Calvo model.

Notes

[1] We are very grateful to Pete Klenow for making these detailed results available to us. We refer the reader to Bils and Klenow (2004) for a description of the data.

[2] Classification of Individual Consumption by Purpose.

[3]For a thorough description of our dataset, we refer the reader to our *Data Description Appendix*, available upon request.

[4] Notice that Bils and Klenow (2004) focused exclusively on the $AR(1)$ model because this assumption was fully consistent with the model they tested.

[5] See, among others, Galí and Gertler (1999), Galí, Gertler, and López-Salido (2001).

[6]Bils and Klenow (2004) p.963 indicate that "This positive correlation is predicted by the Calvo and Taylor sticky price models, since less frequent price changes should mute the volatility of inflation innovation". We note however that in state–dependent models as well, one may expect that when shocks to the marginal cost are large both the frequency and the volatility of price change will be large, inducing a positive cross–sectoral correlation.

[7]These results are reported in an appendix available upon request.

[8]We are grateful to a referee for suggesting this strategy.

[9]We also estimated a FAVAR model based on the principal component analysis. Using this parametric model enables us to estimate an alternative sectoral inflation persistence based on the loadings and the VAR structure imposed on the factors f_t. This delivers very similar results.

[10]For our sample size T, we checked that the standard error of $\epsilon_{i,t}$ is indeed quantitatively irrelevant by replicating the $S = 2000$ simulations using a broad range of standard errors for $\epsilon_{i,t}$, for each i. The resulting theoretical curves were virtually identical.

[11]For instance in the US case the model comprises 260 equations.

[12]This step can be interpreted as an exactly–identified Simulated Method of Moments procedure.

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Appendix

This appendix describes the French data used in the paper and provides additional results on biases. For a description of US data, the reader is referred to Bils and Klenow (2004) and Boivin, Giannoni, and Mihov (2009) and their online appendices. The Transformation codes below are as in Boivin, Giannoni, and Mihov (2009): 1 - no transformation; 2 - first difference; 4 - logarithm; 5 - first difference of logarithm. IPI stands for industrial production index. PPI stands for producer price index.

Appendix A. Sectoral Price Data

Series Description	**COICOP Code**	**Source**	**Trans. Code**
Bread	1111	INSEE	5
Pastry products	1112	INSEE	5
Pastry - cook products	1113	INSEE	5
Cereals	1114	INSEE	5
Meat of beef animals	1121	INSEE	5
Meat of veal animals	1122	INSEE	5
Meat of lamb and horse	1123	INSEE	5
Meat of pork and cooked pork meats	1124	INSEE	5
Meat of poultry	1125	INSEE	5
Other preserved or processed meat and meat-based preparations	1126	INSEE	5
Preserved, frozen, dried or smoked seafood and seafood-based preparations	1132	INSEE	5
Milks and fresh creams	1141	INSEE	5
Yoghurts and milk-based desserts	1142	INSEE	5
Cheeses	1143	INSEE	5
Eggs	1144	INSEE	5
Butters	1151	INSEE	5
Edible oils and margarines	1152	INSEE	5
Frozen, dried fruits or "appertized" fruits	1162	INSEE	5
Frozen, dried or preserved vegetables and other vegetable-based preparations	1172	INSEE	5
Sugar-based products	1181	INSEE	5
Chocolate-based products	1182	INSEE	5
Edible ices, ice creams and sorbets	1183	INSEE	5
Condiments and sauces	1191	INSEE	5
Processed baby food and dietary preparations	1192	INSEE	5
Other food products n.e.c.	1193	INSEE	5

Series Description	COICOP Code	Source	Trans. Code
Chocolate-based powder	1211	INSEE	5
Coffees	1212	INSEE	5
Teas and infusions	1213	INSEE	5
Mineral waters and spring waters	1221	INSEE	5
Sodas, juices and syrops	1222	INSEE	5
Aperitifs	2111	INSEE	5
Brandy and liqueurs	2112	INSEE	5
Wines	2121	INSEE	5
Champagne, other sparkling wines and ciders	2122	INSEE	5
Beers	2131	INSEE	5
Materials for the maintenance and repair of the dwelling	4311	INSEE	5
Floor and wall covering services	4321	INSEE	5
Other services for the maintenance of the dwelling	4322	INSEE	5
Water supply	4411	INSEE	5
Other services related with the dwelling n.e.c.	4414	INSEE	5
Liquefied gas	4522	INSEE	5
Liquid fuels	4531	INSEE	5
Solid fuels	4541	INSEE	5
Bedlinen and bedding	5211	INSEE	5
Other household textiles	5212	INSEE	5
Washing machines	5311	INSEE	5
Cookers	5312	INSEE	5
Refrigerators, freezers	5313	INSEE	5
Other major household appliances	5314	INSEE	5
Small electric household appliances	5321	INSEE	5
Repair of household appliances	5331	INSEE	5
Household articles of porcelain or earthenware and glassware	5411	INSEE	5
Metal kitchen utensils	5412	INSEE	5
Other domestic utensils	5413	INSEE	5
Tools and other equipments for house and garden	5511	INSEE	5
Small articles for routine household maintenance	5611	INSEE	5
Domestic soaps and cleaning products for routine household maintenance	5612	INSEE	5
Other household services	5622	INSEE	5
Parapharmaceutical products	6112	INSEE	5
Therapeutic, appliances and equipment	6113	INSEE	5
Paramedical services	6231	INSEE	5

Series Description	COICOP Code	Source	Trans. Code
Motor cycles and bicycles	7121	INSEE	5
Tyres	7211	INSEE	5
Other spare parts for vehicles and accessories	7212	INSEE	5
Fuels	7221	INSEE	5
Lubricants	7222	INSEE	5
Maintenance of personal transport equipment	7231	INSEE	5
Repair of personal transport equipment	7232	INSEE	5
Toll facilities and car parks	7241	INSEE	5
Other services in respect of personal transport equipment	7242	INSEE	5
Passenger transport by road	7321	INSEE	5
Taxis	7322	INSEE	5
Combined passenger transport (two or more modes of transport)	7351	INSEE	5
Other purchase transport services	7361	INSEE	5
Equipments for the reception, recording and reproduction of pictures and sound	9111	INSEE	5
Photographic and cinematographic equipment and optical instruments	9121	INSEE	5
Information processing equipments including computers and printers	9131	INSEE	5
Recording media for pictures and sound	9141	INSEE	5
Repair of audio-visual, photographic and information processing equipments	9151	INSEE	5
Other major durables for recreation and culture	9211	INSEE	5
Games, toys hobbies	9311	INSEE	5
Equipments for sport, camping and open-air recreation	9321	INSEE	5
Seedling and seeds	9332	INSEE	5
Pets and services for pets	9341	INSEE	5
Recreational services	9411	INSEE	5
Cinemas	9421	INSEE	5
Others cultural shows and museums	9422	INSEE	5
Other cultural services	9424	INSEE	5
Books	9511	INSEE	5
Newspapers	9521	INSEE	5
Other paper-based articles	9531	INSEE	5
Other office accessories	9532	INSEE	5
Package holidays	9611	INSEE	5
Education services	10111	INSEE	5
Restaurants	11111	INSEE	5
Cafés, bars and the like	11112	INSEE	5
School or universitty canteens	11121	INSEE	5

Series Description	**COICOP Code**	**Source**	**Trans. Code**
Professional canteen	11122	INSEE	5
Hotels, including boarding houses	11211	INSEE	5
Boarding schools or university pension	11212	INSEE	5
Holiday accomodation	11213	INSEE	5
Hairdressing	12111	INSEE	5
Other aesthetic services	12112	INSEE	5
Perfumes and beauty products	12131	INSEE	5
Personal care products	12132	INSEE	5
Other toilet articles and equipment	12133	INSEE	5
Jewelry, clocks and watches	12311	INSEE	5
Leather working and travel goods	12321	INSEE	5
Other personal effects, including repair	12322	INSEE	5
Fees for administrative formalities ans other private services	12712	INSEE	5

Appendix B. Data Used in PCA

Series Description	Source	Trans. Code
Industrial Production Index, (2005 = 100) - Buildings (MIG, F CC1) - seasonally and working day adjusted	INSEE	5
Industrial Production Index, (2005 = 100) - Civil engineering (MIG, F CC2) - seasonally and working day adjusted	INSEE	5
Industrial Production Index, (2005 = 100) - Intermediate Goods Industry (MIG, MIG ING) - seasonally and working day adjusted	INSEE	5
Industrial Production Index, (2005 = 100) - Capital Goods Industry (MIG, MIG CAG) - seasonally and working day adjusted	INSEE	5
Industrial Production Index, (2005 = 100) - Durable Consumer Goods Industry (MIG, MIG DCOG) - seasonally and working day adjusted	INSEE	5
Industrial Production Index, (2005 = 100) - Non-durable Consumer Goods Industry (MIG, MIG NDCOG) - seasonally and working day adjusted	INSEE	5
Industrial Production Index, (2005 = 100) - Energy (MIG, MIG NRG) - seasonally and working day adjusted	INSEE	5
Industrial Production Index, (2005 = 100) - Construction (MIG, F) - seasonally and working day adjusted	INSEE	5
Industrial Production Index (2005 = 100) - Mining and Quarrying (NAF rév. 2, B) - seasonally and working day adjusted	INSEE	5
Industrial Production Index (2005 = 100) - Manufacturing (NAF rév. 2, C) - seasonally and working day adjusted	INSEE	5
Industrial Production Index (2005 = 100) - Electricity, gas, steam and air conditioning supply (NAF rév. 2, D) - seasonally and working day adjusted	INSEE	5
Basic Hourly Wage of a worker index / SHBO index	DARES	5
Basic Monthly Wage of an employee index / SMB index	DARES	5
New job vacancies - SA	OECD	5
New job vacancies sa / Quantum (non-additive or stock figures) - SA	OECD	5
Unemployment level: registered (all persons) / Quantum (non-additive or stock figures) NSA	OECD	1
Unemployment level: registered (all persons) sa / Quantum (non-additive or stock figures) SA	OECD	1
Unemployment level: survey-based (all persons) sa / Quantum (non-additive or stock figures) SA	OECD	1
Harmonised unemployment rate: females / Quantum (non-additive or stock figures) NSA	OECD	1
Harmonised unemployment rate: females sa / Quantum (non-additive or stock figures) SA	OECD	1
Harmonised unemployment rate: males / Quantum (non-additive or stock figures) NSA	OECD	1
Harmonised unemployment rate: males sa / Quantum (non-additive or stock figures) SA	OECD	1
Harmonised unemployment rate: all persons / Quantum (non-additive or stock figures) NSA	OECD	1
Harmonised unemployment rate: all persons sa / Quantum (non-additive or stock figures) SA	OECD	1
Unemployment rate: survey-based (all persons) sa / Quantum (non-additive or stock figures) SA	OECD	1
New job seekers sa / Index publication base SA	OECD	4
Standardised unemployment, Rate, 25 and over, Female; ; Neither seasonally nor working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, 25 and over, Male; ; Neither seasonally nor working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, 25 and over, Total (male and female); ; Neither seasonally nor working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Total (all ages), Female; ; Neither seasonally nor working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Total (all ages), Male; ; Neither seasonally nor working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Total (all ages), Total (male and female); ; Neither seasonally nor working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Under 25, Female; ; Neither seasonally nor working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Under 25, Male; ; Neither seasonally nor working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Under 25, Total (male and female); ; Neither seasonally nor working day adjusted	EUROSTAT	1

Series Description	Source	Trans. Code
Standardised unemployment, Rate, 25 and over, Female; ; Seasonally adjusted, not working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, 25 and over, Male; ; Seasonally adjusted, not working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, 25 and over, Total (male and female); ; Seasonally adjusted, not working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Total (all ages), Female; ; Seasonally adjusted, not working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Total (all ages), Male; ; Seasonally adjusted, not working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Under 25, Female; ; Seasonally adjusted, not working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Under 25, Male; ; Seasonally adjusted, not working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Under 25, Total (male and female); ; Seasonally adjusted, not working day adjusted	EUROSTAT	1
Standardised unemployment, Rate, Total (all ages), Total (male and female); ; Seasonally adjusted, not working day adjusted	EUROSTAT	1
Work started for dwellings sa / Monthly Level SA	OECD	4
Quarterly business survey in the building construction - Expected housing starts - SA	INSEE	1
Monthly Industry survey : Manufacturing - Mining and quarrying n.e.c. - Stocks of finished goods (Level - SA - balance of opinion)	INSEE	1
Monthly Industry survey : Manufacturing - Stocks of finished goods (Level - SA - balance of opinion)	INSEE	1
Monthly Industry survey : Manufacturing - Mining and quarrying n.e.c. - Demand and total order levels (Level - SA - balance of opinion)	INSEE	1
Monthly Industry survey : Manufacturing - Demand and total order levels (Level - SA - balance of opinion)	INSEE	1
Monthly Industry survey : Manufacturing - Mining and quarrying n.e.c. - Demand and export order levels (Level - SA - balance of opinion)	INSEE	1
Monthly Industry survey : Manufacturing - Demand and export order levels (Level - SA - balance of opinion)	INSEE	1
Share prices: Paris Stock Exchange SBF 250 ind / Growth rate previous period - Neither seasonally nor working day adjusted	OECD	1
Share prices: Paris Stock Exchange SBF 250 ind / Index publication base - Neither seasonally nor working day adjusted	OECD	5
CAC 40 Index - closing price - Neither seasonally nor working day adjusted	BDF	5
CAC 40 INDEX	DATASTREAM	5
CAC 40 INDEX - DIVIDEND YIELD	DATASTREAM	1
CAC 40 INDEX - PRICE EARNINGS RATIO	DATASTREAM	1
DATASTREAM AGGREGATE INDEX - FRANCE MARKET - PRICE INDEX	DATASTREAM	5
DATASTREAM AGGREGATE INDEX - FRANCE MARKET - DIVIDEND YIELD	DATASTREAM	1
DATASTREAM AGGREGATE INDEX - FRANCE MARKET - PRICE EARNINGS RATIO	DATASTREAM	1
Real effective exchange rates - CPI Based / Index publication base - NSA	OECD	1
99 FRF-EUR/USD exchange rate monthly average - index / Index publication base - NSA	OECD	5
99 FRF-EUR/USD exchange rate monthly average / Quantum (non-additive or stock figures) - NSA	OECD	5
USD/99 FRF-EUR exchange rate end period / Quantum (non-additive or stock figures) - NSA	OECD	5
EXCH RATE: FR FRANCS/1 USD, SPOT AT 2:15 PM (CET) DandW,M,Q-AVG	BIS	5
EER, NOMINAL, FR FRANC (NARROW INDEX: 26 CTY) (BIS), M-END	BIS	5
EFF.EXCH.RATE, NOMINAL, FR FRANC (NARROW INDEX: 26 CTY) (BIS), M-END	BIS	5
INT.RATE, MONEY-MKT, 13-WEEK TREASURY BILLS, AT ISSUE, M-AVG	BIS	2
INT.RATE, MONEY-MKT, T-BILLS, 3-M(REMAIN.MATUR),MKT YIELD,D,M-AVG	BIS	2
INT.RATE, MONEY-MKT, T-BILLS, 1-M(REMAIN.MATUR),MKT YIELD,D,M-AVG	BIS	2

Series Description	Source	Trans. Code
INT.RATE, MONEY-MKT, T-BILLS, 6-M(REMAIN.MATUR),MKT YIELD,D,M-AVG	BIS	2
YIELD, SEC.MKT, GOVT BONDS (BENCHMK) 10 YRS, EMU C.C., D,M-AVG	BIS	2
YIELD, SECOND.MKT, GOVERNMENT BONDS,LONG TERM(OVER 7 YRS), M-END	BIS	2
YIELD, SECOND.MKT, TREASURY BILLS (BENCHMARK), 5 YEARS, D,M-AVG	BIS	2
YIELD, SECOND.MKT, GOVT BONDS (BENCHMARK), 10 YEARS, D,M-AVG -	BIS	2
YIELD, SECOND.MKT, GOVT BONDS (BENCHMARK), 30 YEARS, D,M-AVG -	BIS	2
YIELD, SECOND.MKT, PUBLIC and SEMI-PUBLIC SECTOR BONDS, M-END	BIS	2
INT.RATE, BANK LOANS, BASE RATE, M-END -DISC	BIS	2
INT.RATE, HOUSING LOANS QUALIFYING FOR STATE ASSISTANCE, M-END	BIS	2
INT.RATE, SAVING BOOK DEPOS AT SAVS BKS, BASIC RATE, M-END	BIS	2
INT.RATE, HOUSING SAVINGS PLANS,MIN.RATE INCL. PREMIUM,M-END	BIS	2
FRENCH GOVERNMENT BOND INDEX 10+ YEAR (LCL)	DATASTREAM	5
CONVERT(QS.D.IFRPHF10.VAL,Monthly,Constant,Averaged) Benchmark bond rate - France - 10 years - closing price	BDF	2
France ir swap 10 years - CGBI WGBI FR 10+Y (L) - TOT RETURN IND	DATASTREAM	2
France ir swap 2 years	DATASTREAM	2
France ir swap 3 years	DATASTREAM	2
France ir swap 4 years	DATASTREAM	2
France ir swap 5 years	DATASTREAM	2
France ir swap 7 years	DATASTREAM	2
spread 10ans = Corporate bond rate (MT M H30021 B M T B X) - benchmark bond rate 10 years (QS.D.IFRPHF10.VAL) France	BDF	1
Monetary aggregate M1 - stock - central government + MFIs + POST OFFICE GIRO - NSA	BDF	5
Monetary aggregate M1 - flow - central government + MFIs + POST OFFICE GIRO - NSA	BDF	1
Monetary aggregate M1 - rate pct. - central government + MFIs + POST OFFICE GIRO - NSA	BDF	1
Monetary aggregate (M1 - L10) - stock - central government + MFIs + POST OFFICE GIRO - NSA	BDF	5
Monetary aggregate (M1 - L10) - flow - central government + MFIs + POST OFFICE GIRO - NSA	BDF	1
Monetary aggregate (M1 - L10) - rate pct. - central government + MFIs + POST OFFICE GIRO - NSA	BDF	1
Monetary aggregate M2 - stock - central government + MFIs + POST OFFICE GIRO - NSA	BDF	5
Monetary aggregate M2 - flow - central government + MFIs + POST OFFICE GIRO - NSA	BDF	1
Monetary aggregate M2 - rate pct. - central government + MFIs + POST OFFICE GIRO - NSA	BDF	1
Monetary aggregate M3 - stock - central government + MFIs + POST OFFICE GIRO - NSA	BDF	5
Monetary aggregate M3 - flow - central government + MFIs + POST OFFICE GIRO - NSA	BDF	1
Monetary aggregate M3 - rate pct. - central government + MFIs + POST OFFICE GIRO - NSA	BDF	1
Core inflation index (monthly, seasonally adjusted, corrected for tax measures) - Food industry - excl. meats, dairy and exotic products	INSEE	5
Core inflation index (monthly, seasonally adjusted, corrected for tax measures) - Manufacturing	INSEE	5
Core inflation index (monthly, seasonally adjusted, corrected for tax measures) - Services	INSEE	5
Core inflation index (monthly, seasonally adjusted, corrected for tax measures) - Total	INSEE	5

Series Description	Source	Trans. Code
Hourly wage rate: manufacturing and energy / Index publication base - End - Labour compensation - NSA	OECD	5
Hourly guaranteed minimum wage	DARES	5
Consumer Surveys - Synthetic index	INSEE	1
Consumer Surveys - General economic situation, past 12 months	INSEE	1
Consumer Surveys - General economic situation, next 12 months	INSEE	1
Consumer Surveys - Unemployment, next 12 months	INSEE	1
Consumer Surveys - Consumer prices, past 12 months	INSEE	1
Consumer Surveys - Consumer prices, next 12 months	INSEE	1
Consumer Surveys - Major purchases intentions, next 12 months	INSEE	1
Consumer Surveys - Savings intentions, next 12 months	INSEE	1
Consumer Surveys Current saving capacity	INSEE	1
Consumer Surveys Financial situation, past 12 months	INSEE	1
Consumer Surveys Financial situation, next 12 months	INSEE	1
Consumer Surveys - Savings intentions, next 12 months	INSEE	1
Car registration, New commercial vehicles; Absolute value; European Central Bank; Working day and seasonally adjusted	EUROSTAT	4
Car registration, New heavy commercial vehicles; Absolute value; European Central Bank; Working day and seasonally adjusted	EUROSTAT	4
Car registration, New light commercial vehicles; Absolute value; European Central Bank; Working day and seasonally adjusted	EUROSTAT	4
Car registration, New passenger car; Absolute value; European Central Bank; Working day and seasonally adjusted	EUROSTAT	4
IPI - Tanning and dressing of leather; manufacture of luggage, handbags, saddlery and harness; dressing and dyeing of fur (NAF rév. 2, 15.1) -SA	INSEE	5
IPI - Manufacture of footwear (NAF rév. 2, 15.2) -SA	INSEE	5
IPI - Manufacture of products of wood, cork, straw and plaiting materials (NAF rév. 2, 16.2) -SA	INSEE	5
IPI - Manufacture of pulp, paper and paperboard (NAF rév. 2, 17.1) -SA	INSEE	5
IPI - Manufacture of articles of paper and paperboard (NAF rév. 2, 17.2) -SA	INSEE	5
IPI - Printing and service activities related to printing (NAF rév. 2, 18.1) -SA	INSEE	5
IPI - Manufacture of refined petroleum products (NAF rév. 2, 19.2) -SA	INSEE	5
IPI - Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms (NAF rév. 2, 20.1) -SA	INSEE	5
IPI - Manufacture of pesticides and other agrochemical products (NAF rév. 2, 20.2) -SA	INSEE	5
IPI - Manufacture of paints, varnishes and similar coatings, printing ink and mastics (NAF rév. 2, 20.3) -SA	INSEE	5
IPI - Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations (NAF rév. 2, 20.4) -SA	INSEE	5
IPI - Manufacture of other chemical products (NAF rév. 2, 20.5) -SA	INSEE	5
IPI - Manufacture of man-made fibres (NAF rév. 2, 20.6) -SA	INSEE	5
IPI - Manufacture of basic pharmaceutical products (NAF rév. 2, 21.1) -SA	INSEE	5
IPI - Manufacture of pharmaceutical preparations (NAF rév. 2, 21.2) -SA	INSEE	5
IPI - Manufacture of rubber products (NAF rév. 2, 22.1) -SA	INSEE	5
IPI - Manufacture of plastics products (NAF rév. 2, 22.2) -SA	INSEE	5
IPI - Manufacture of glass and glass products (NAF rév. 2, 23.1) -SA	INSEE	5

Series Description	Source	Trans. Code
IPI - Manufacture of refractory products (NAF rév. 2, 23.2) -SA	INSEE	5
IPI - Manufacture of clay building materials (NAF rév. 2, 23.3) -SA	INSEE	5
IPI - Manufacture of other porcelain and ceramic products (NAF rév. 2, 23.4) -SA	INSEE	5
IPI - Manufacture of cement, lime and plaster (NAF rév. 2, 23.5) -SA	INSEE	5
IPI - Manufacture of articles of concrete, cement and plaster (NAF rév. 2, 23.6) -SA	INSEE	5
IPI - Manufacture of abrasive products and non-metallic mineral products n.e.c. (NAF rév. 2, 23.9) -SA	INSEE	5
IPI - Manufacture of basic iron and steel and of ferro-alloys (NAF rév. 2, 24.1) -SA	INSEE	5
IPI - Manufacture of tubes, pipes, hollow profiles and related fittings, of steel (NAF rév. 2, 24.2) -SA	INSEE	5
IPI - Manufacture of other products of first processing of steel (NAF rév. 2, 24.3) -SA	INSEE	5
IPI - Manufacture of basic precious and other non-ferrous metals (NAF rév. 2, 24.4) -SA	INSEE	5
IPI - Casting of metals (NAF rév. 2, 24.5) -SA	INSEE	5
IPI - Manufacture of structural metal products (NAF rév. 2, 25.1) -SA	INSEE	5
IPI - Manufacture of tanks, reservoirs and containers of metal (NAF rév. 2, 25.2) -SA	INSEE	5
IPI - Manufacture of steam generators, except central heating hot water boilers (NAF rév. 2, 25.3) -SA	INSEE	5
IPI - Manufacture of weapons and ammunition (NAF rév. 2, 25.4) -SA	INSEE	5
IPI - Forging, pressing, stamping and roll-forming of metal; powder metallurgy (NAF rév. 2, 25.5) -SA	INSEE	5
IPI - Treatment and coating of metals; machining (NAF rév. 2, 25.6) -SA	INSEE	5
IPI - Manufacture of cutlery, tools and general hardware (NAF rév. 2, 25.7) -SA	INSEE	5
IPI - Manufacture of other fabricated metal products (NAF rév. 2, 25.9) -SA	INSEE	5
IPI - Manufacture of electronic components and boards (NAF rév. 2, 26.1) -SA	INSEE	5
IPI - Manufacture of computers and peripheral equipment (NAF rév. 2, 26.2) -SA	INSEE	5
IPI - Manufacture of communication equipment (NAF rév. 2, 26.3) -SA	INSEE	5
IPI - Manufacture of consumer electronics (NAF rév. 2, 26.4) -SA	INSEE	5
IPI - Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks (NAF rév. 2, 26.5) -SA	INSEE	5
IPI - Manufacture of irradiation, electromedical and electrotherapeutic equipment (NAF rév. 2, 26.6) -SA	INSEE	5
IPI - Manufacture of optical instruments and photographic equipment (NAF rév. 2, 26.7) -SA	INSEE	5
IPI - Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus (NAF rév. 2, 27.1) -SA	INSEE	5
IPI - Manufacture of batteries and accumulators (NAF rév. 2, 27.2) -SA	INSEE	5
IPI - Manufacture of wiring and wiring devices (NAF rév. 2, 27.3) -SA	INSEE	5
IPI - Manufacture of electric lighting equipment (NAF rév. 2, 27.4) -SA	INSEE	5
IPI - Manufacture of domestic appliances (NAF rév. 2, 27.5) -SA	INSEE	5
IPI - Manufacture of other electrical equipment (NAF rév. 2, 27.9) -SA	INSEE	5
IPI - Manufacture of general-purpose machinery (NAF rév. 2, 28.1) -SA	INSEE	5
IPI - Manufacture of other general-purpose machinery (NAF rév. 2, 28.2) -SA	INSEE	5
IPI - Manufacture of agricultural and forestry machinery (NAF rév. 2, 28.3) -SA	INSEE	5
IPI - Manufacture of metal forming machinery and machine tools (NAF rév. 2, 28.4) -SA	INSEE	5

Series Description	Source	Trans. Code
IPI - Manufacture of other special-purpose machinery (NAF rév. 2, 28.9) -SA	INSEE	5
IPI - Manufacture of motor vehicles (NAF rév. 2, 29.1) -SA	INSEE	5
IPI - Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers (NAF rév. 2, 29.2) -SA	INSEE	5
IPI - Manufacture of parts and accessories for motor vehicles (NAF rév. 2, 29.3) -SA	INSEE	5
IPI - Building of ships and boats (NAF rév. 2, 30.1) -SA	INSEE	5
IPI - Manufacture of air and spacecraft and related machinery (NAF rév. 2, 30.3) -SA	INSEE	5
IPI - Manufacture of furniture (NAF rév. 2, 31.0) -SA	INSEE	5
IPI - Manufacture of medical and dental instruments and supplies (NAF rév. 2, 32.5) -SA	INSEE	5
IPI - Repair of fabricated metal products, machinery and equipment (NAF rév. 2, 33.1) -SA	INSEE	5
IPI - Installation of industrial machinery and equipment (NAF rév. 2, 33.2) -SA	INSEE	5
IPI - Electric power generation, transmission and distribution (NAF rév. 2, 35.1) -SA	INSEE	5
IPI - Manufacture of gas; distribution of gaseous fuels through mains (NAF rév. 2, 35.2) -SA	INSEE	5
IPI - Water collection, treatment and supply (NAF rév. 2, 36.0) -SA	INSEE	5
IPI - Extraction of crude petroleum (NAF rév. 2, 06.1) -SA	INSEE	5
IPI - Extraction of natural gas (NAF rév. 2, 06.2) -SA	INSEE	5
IPI - Quarrying of stone, sand and clay (NAF rév. 2, 08.1) -SA	INSEE	5
IPI - Mining and quarrying n.e.c. (NAF rév. 2, 08.9) -SA	INSEE	5
IPI - Processing and preserving of meat and production of meat products (NAF rév. 2, 10.1) -SA	INSEE	5
IPI - Processing and preserving of fruit and vegetables (NAF rév. 2, 10.3) -SA	INSEE	5
IPI - Manufacture of vegetable and animal oils and fats (NAF rév. 2, 10.4) -SA	INSEE	5
IPI - Manufacture of dairy products (NAF rév. 2, 10.5) -SA	INSEE	5
IPI - Manufacture of grain mill products, starches and starch products (NAF rév. 2, 10.6) -SA	INSEE	5
IPI - Manufacture of bakery and farinaceous products (NAF rév. 2, 10.7) -SA	INSEE	5
IPI - Manufacture of other food products (NAF rév. 2, 10.8) -SA	INSEE	5
IPI - Manufacture of prepared animal feeds (NAF rév. 2, 10.9) -SA	INSEE	5
IPI - Manufacture of beverages (NAF rév. 2, 11.0) -SA	INSEE	5
IPI - Manufacture of tobacco products (NAF rév. 2, 12.0) -SA	INSEE	5
IPI - Preparation and spinning of textile fibres (NAF rév. 2, 13.1) -SA	INSEE	5
IPI - Weaving of textiles (NAF rév. 2, 13.2) -SA	INSEE	5
IPI - Finishing of textiles (NAF rév. 2, 13.3) -SA	INSEE	5
IPI - Manufacture of other textiles (NAF rév. 2, 13.9) -SA	INSEE	5
IPI - Manufacture of wearing apparel, except fur apparel (NAF rév. 2, 14.1) -SA	INSEE	5
IPI - Manufacture of knitted and crocheted apparel (NAF rév. 2, 14.3) -SA	INSEE	5
PPI - CPF 08.11 - Quarrying of ornamental and building stone, limestone, gypsum, chalk and slate	INSEE	5
PPI - CPF 08.12 - Operation of gravel and sand pits; mining of clays and kaolin	INSEE	5
PPI - CPF 13.10 - Preparation and spinning of textile fibres	INSEE	5

Series Description	Source	Trans. Code
PPI - CPF 13.20 - Weaving of textiles	INSEE	5
PPI - CPF 13.91 - Manufacture of knitted and crocheted fabrics	INSEE	5
PPI - CPF 13.92 - Manufacture of made-up textile articles, except apparel	INSEE	5
PPI - CPF 14.1 - Manufacture of wearing apparel, except fur apparel	INSEE	5
PPI - CPF 14.3 - Manufacture of knitted and crocheted apparel	INSEE	5
PPI - CPF 14.31 - Manufacture of knitted and crocheted hosiery	INSEE	5
PPI - CPF 17.11 - Manufacture of pulp	INSEE	5
PPI - CPF 17.12 - Manufacture of paper and paperboard	INSEE	5
PPI - CPF 17.21 - Manufacture of corrugated paper and paperboard and of containers of paper and paperboard	INSEE	5
PPI - CPF 17.29 - Manufacture of other articles of paper and paperboard	INSEE	5
PPI - CPF 20.12 - Manufacture of dyes and pigments	INSEE	5
PPI - CPF 20.13 - Manufacture of other inorganic basic chemicals	INSEE	5
PPI - CPF 20.15 - Manufacture of fertilisers and nitrogen compounds	INSEE	5
PPI - CPF 20.16 - Manufacture of plastics in primary forms	INSEE	5
PPI - CPF 20.30 - Manufacture of paints, varnishes and similar coatings, printing ink and mastics	INSEE	5
PPI - CPF 20.41 - Manufacture of soap and detergents, cleaning and polishing preparations	INSEE	5
PPI - CPF 20.53 - Manufacture of essential oils	INSEE	5
PPI - CPF 22.19 - Manufacture of other rubber products	INSEE	5
PPI - CPF 22.21 - Manufacture of plastic plates, sheets, tubes and profiles	INSEE	5
PPI - CPF 22.22 - Manufacture of plastic packing goods	INSEE	5
PPI - CPF 22.23 - Manufacture of builders ware of plastic	INSEE	5
PPI - CPF 22.29 - Manufacture of other plastic products	INSEE	5
PPI - CPF 23.13 - Manufacture of hollow glass	INSEE	5
PPI - CPF 23.19 - Manufacture and processing of other glass, including technical glassware	INSEE	5
PPI - CPF 23.20 - Manufacture of refractory products	INSEE	5
PPI - CPF 23.5 - Manufacture of cement, lime and plaster	INSEE	5
PPI - CPF 23.51 - Manufacture of cement	INSEE	5
PPI - CPF 23.70 - Cutting, shaping and finishing of stone	INSEE	5
PPI - CPF 25.73 - Manufacture of tools	INSEE	5
PPI - CPF 25.99 - Manufacture of other fabricated metal products n.e.c.	INSEE	5
PPI - CPF 28.14 - Manufacture of other taps and valves	INSEE	5
PPI - CPF 28.15 - Manufacture of bearings, gears, gearing and driving elements	INSEE	5
PPI - CPF 31.01 - Manufacture of office and shop furniture	INSEE	5
PPI - CPF 31.02 - Manufacture of kitchen furniture	INSEE	5
PPI - CPF 31.03 - Manufacture of mattresses	INSEE	5
PPI - CPF 24.3 - Manufacture of other products of first processing of steel	INSEE	5

Series Description	Source	Trans. Code
PPI - CPF 28.21 - Manufacture of ovens, furnaces and furnace burners	INSEE	5
PPI - CPF 24.10 - Manufacture of basic iron and steel and of ferro-alloys	INSEE	5
PPI - CPF 27.11 - Manufacture of electric motors, generators and transformers	INSEE	5
PPI - CPF 27.20 - Manufacture of batteries and accumulators	INSEE	5
PPI - CPF 27.40 - Manufacture of electric lighting equipment	INSEE	5
PPI - CPF 20.17 - Manufacture of synthetic rubber in primary forms	INSEE	5
PPI - CPF 23.32 - Manufacture of bricks, tiles and construction products, in baked clay	INSEE	5
PPI - CPF 24.43 - Lead, zinc and tin production	INSEE	5
PPI - CPF 24.45 - Other non-ferrous metal production	INSEE	5
PPI - CPF 25.7 - Manufacture of cutlery, tools and general hardware	INSEE	5
PPI - CPF 25.72 - Manufacture of locks and hinges	INSEE	5
PPI - CPF 29.31 - Manufacture of electrical and electronic equipment for motor vehicles	INSEE	5
PPI - CPF 23.31 - Manufacture of ceramic tiles and flags	INSEE	5
PPI - CPF 23.4 - Manufacture of other porcelain and ceramic products	INSEE	5
PPI - CPF 23.41 - Manufacture of ceramic household and ornamental articles	INSEE	5
PPI - CPF 23.42 - Manufacture of ceramic sanitary fixtures	INSEE	5
PPI - CPF 20.11 - Manufacture of industrial gases	INSEE	5
PPI - CPF 23.64 - Manufacture of mortars	INSEE	5
PPI - CPF 23.61 - Manufacture of concrete products for construction purposes	INSEE	5
PPI - CPF 22.1 - Manufacture of rubber products	INSEE	5
PPI - CPF 23.1 - Manufacture of glass and glass products	INSEE	5
PPI - CPF 23.12 - Shaping and processing of flat glass	INSEE	5
PPI - CPF 16.24 - Manufacture of wooden containers	INSEE	5
PPI - CPF 20.51 - Manufacture of explosives	INSEE	5
PPI - CPF 23.91 - Production of abrasive products	INSEE	5
PPI - CPF 17.22 - Manufacture of household and sanitary goods and of toilet requisites	INSEE	5
PPI - CPF 24.20 - Manufacture of other products of first processing of steel	INSEE	5
PPI - CPF 25.92 - Manufacture of light metal packaging	INSEE	5
PPI - CPF 15.11 - Tanning and dressing of leather, dressing and dyeing of fur	INSEE	5
PPI - CPF 25.94 - Manufacture of fasteners and screw machine products	INSEE	5
PPI - CPF 24.4 - Manufacture of basic previous and other non-ferrous metals	INSEE	5
PPI - CPF 24.42 - Aluminium production	INSEE	5
PPI - CPF 24.44 - Copper production	INSEE	5
PPI - CPF 28.30 - Manufacture of agricultural and forestry machinery	INSEE	5
PPI - CPF 10.32 - Manufacture of fruit and vegetable juice	INSEE	5
PPI - CPF 10.4 - Manufacture of vegetable and animal oils and fats	INSEE	5

Series Description	Source	Trans. Code
PPI - CPF 10.41 - Manufacture of oils and fats	INSEE	5
PPI - CPF 10.51 - Operation of dairies and cheese making	INSEE	5
PPI - CPF 10.52 - Manufacture of ice cream	INSEE	5
PPI - CPF 10.61 - Manufacture of grain mill products	INSEE	5
PPI - CPF 10.71 - Manufacture of bread - manufacture of fresh pastry goods and cakes	INSEE	5
PPI - CPF 10.72 - Manufacture of rusks and biscuits - manufacture of preserved pastry goods and cakes	INSEE	5
PPI - CPF 10.81 - Manufacture of sugar	INSEE	5
PPI - CPF 10.82 - Manufacture of cocoa, chocolate and sugar confectionery	INSEE	5
PPI - CPF 10.83 - Processing of tea and coffee	INSEE	5
PPI - CPF 10.84 - Manufacture of condiments and seasonings	INSEE	5
PPI - CPF 10.86 - Manufacture of homogenised food preparations and dietetic food	INSEE	5
PPI - CPF 10.91 - Manufacture of prepared feeds for farm animals	INSEE	5
PPI - CPF 10.92 - Manufacture of prepared pet foods	INSEE	5
PPI - CPF 11.01 - Distilling, rectifying and blending of spirits	INSEE	5
PPI - CPF 11.06 - Manufacture of malt	INSEE	5
PPI - CPF 11.07 - Manufacture of soft drinks - production of mineral waters and other bottled waters	INSEE	5
PPI - CPF 20.52 - Manufacture of glues	INSEE	5
PPI - CPF 21.20 - Manufacture of pharmaceutical preparations	INSEE	5
PPI - CPF 23.62 - Manufacture of plaster products for construction purposes	INSEE	5
PPI - CPF 23.63 - Manufacture of ready-mixed concrete	INSEE	5
PPI - CPF 23.99 - Manufacture of other non-metallic mineral products n.e.c.	INSEE	5
PPI - CPF 25.21 - Manufacture of central heating radiators and boilers	INSEE	5
PPI - CPF 27.51 - Manufacture of electric domestic appliances	INSEE	5
PPI - CPF 29.10 - Manufacture of motor vehicles	INSEE	5
PPI - CPF 29.20 - Manufacture of bodies (coachwork) for motor vehicles - manufacture of trailers and semi-trailers	INSEE	5
PPI - CPF 24.51 - Casting of iron	INSEE	5
PPI - CPF 24.52 - Casting of steel	INSEE	5
PPI - CPF 24.53 - Casting of light metals	INSEE	5
PPI - CPF 24.54 - Casting of other non-ferrous metals	INSEE	5
PPI - CPF 25.12 - Manufacture of doors and windows of metal	INSEE	5

Appendix C. Additional Results on Biases

This appendix discusses several sources of measurement error and biases that may potentially explain the low serial correlation of sectoral inflation rates obtained with raw data in section 2.

First, as explained by Bils and Klenow (1994), serially uncorrelated errors in the price level could potentially lower the degree of estimated inflation persistence. In our dataset as well as in Bils and Klenow's, given the sampling procedure and the data collection process, measurement errors may arise mainly at the price quote level. In the US case, as reported by Bils and Klenow (2004), price quotes are collected in 20000 outlets, across 88 geographic areas, and the median number of quotes used to produce a product category price index is around 700. Since it is reasonable to assume that the correlation between measurement errors are low enough, measurement errors must be washed out by aggregation at the product category level given these numbers. One has to assume an unrealistic standard deviation for individual measurement errors to matter for sectoral persistence (see footnote 16 in Bils and Klenow, 2004). In the French CPI dataset, the numbers are of the same order as in the US CPI : price quotes are drawn from more than 10000 outlets in 96 French cities.[1] For each product category the average number of price quotes is 953 each month, and the median number is 676. Overall, given that both in the French and in the US CPI, individual price changes are cross–checked when they exceed a certain level, measurement errors cannot be the cause of a bias in autoregressive coefficient. In addition as Boivin, Giannoni, and Mihov (2009) observed in the US case, there is a strong positive cross-section correlation between the frequency of price changes and the volatility of the sectoral idiosyncratic shock (we observe in the French case a similar correlation if we tentatively capture the volatility of the sectoral idiosyncratic shock by the standard deviation of residual of the AR(1) process for the inflation rate, in Table 1). As these authors, we can assume that this correlation would not be observed if sectoral inflation dynamics were dominated by measurement errors.

Second, there may be a misspecification bias. In particular the AR(1) model may not be a relevant reduced form. As we saw above, this might not be an issue since we obtain broadly similar results with an AR(1) or with an AR(5) model. Another source of misspecification, shared with Bils and Klenow (2004), is that we use non-seasonally adjusted data. Seasonality might spoil the parameter estimates, and in particular create a bias in inflation persistence. To address these concerns we have produced similar scatter plots as Figure 1 using seasonally adjusted data.[2] Results, available upon request, were very similar to those of Figure 1.

[1] See INSEE (1998)

[2] To obtain seasonally adjusted data, we regress sectoral inflations on seasonal dummy variables, as in Batini (2006) for example.

Third, another well–known source of bias is that the OLS estimate of an AR(1) parameter is biased downward in a finite sample. One strategy to address this concern could consist in resorting to a bias-correcting procedure, such as the median unbiased estimation. However, the OLS small sample biases are mainly relevant for values of the AR(1) parameter close to 1. Here, the persistence degrees are typically much lower than 1, with far too small values to change the overall picture.

To illustrate this consider the simple, analytical, bias–correction estimation formula of an AR(1) coefficient proposed by Orcutt and Winokur (1969):

$$\tilde{\rho} = \frac{T}{T-3}(\hat{\rho}^{OLS} + \frac{1}{T})$$

where $\hat{\rho}^{OLS}$ is the OLS estimate and $\tilde{\rho}$ the mean-unbiased corrected estimate. In the French case, for example, the sample size is $T = 201$, and the median $\hat{\rho}^{OLS}$ is 0.2865. This leads to an essentially similar bias-corrected estimate of $\tilde{\rho} = 0.2969$. Even for the maximum degree of persistence across sectors ($\max(\hat{\rho}_i^{OLS}) = 0.7797$), the bias-corrected parameter remains quantitatively rather close to $\hat{\rho}^{OLS}$, with $\tilde{\rho} = 0.7966$.

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- INSEE (1998). *Pour comprendre l'Indice des prix*, INSEE Méthodes, n. 81-82.
- Orcutt, G. and Winokur, H. (1969), First Order Autoregression: Inference, Estimation, and Prediction, Econometrica, 37, 1–14.

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