How do house prices affect wages? A comparison between France and Germany

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While wages and the cost of housing have increased in both France and Germany over the 2000s, significant divergences have appeared between the two countries: in France, the increase in wages and house prices has been very rapid (an increase of 41 and 250 percentage points respectively over the period from the fourth quarter of 1996 to the same quarter of 2012), while the pace has been much slower in Germany (an increase of 22 and 107 percentage points respectively). This suggests that differences in house prices may have contributed to the divergence in wage growth between Germany and France. In this article, the author provides evidence to support this thesis. The analysis proceeds in two stages. First price indices are developed which take account of house prices. Second, these price indices are used to quantify the impact of trends in the housing market on the differences in wage growth between the two countries. Assuming a unitary indexation of wages to price levels, the author concludes that the adjusted price indices can explain up to 70% of the difference in wage growth between the two countries.

Key words: wages, cost of housing, French economy, German economy, CPI

JEL codes: J3, R21

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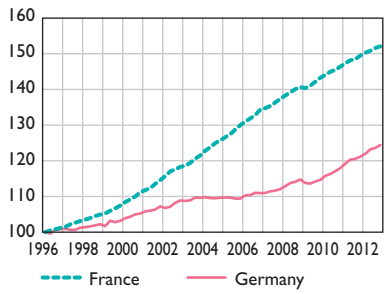
Wages grew at a much faster rate in France than in Germany over the period 1996-2012 (see Chart 1). Very significant differences in house price trajectories have also been observed, with a sharp increase in France and almost stagnant prices in Germany (see Chart 2). The difference in trends in housing costs is less marked with regard to rents (see Chart 3). This trend does, however, need to be put into perspective against recent developments. From 2008, there was a rebound in wages and house prices in Germany, while in France they more or less stagnated. Nevertheless, the upward long-term trend is higher in France for both indicators.

Chart 1 Average wage per capita, nominal values

(Q1 1996 = 100)

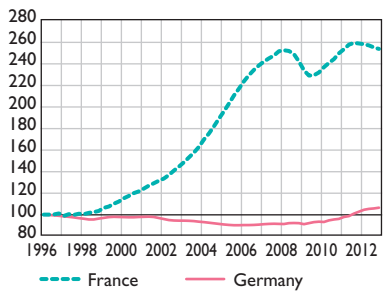


Sources: Insee (France), OECD (Germany).

The objective of this study is to examine the relationship between changes in the cost of housing and wages in France and Germany, in order to determine to what extent differences in rates of growth in house prices[1] between France and Germany during the 2000s can explain differences in wage growth. Given that the cost of labour is a key determinant of the competitiveness of French and German firms, house price trends may be one explanatory factor for the decline in French firms' competitiveness with respect

Chart 2 Evolution of the price of dwellings

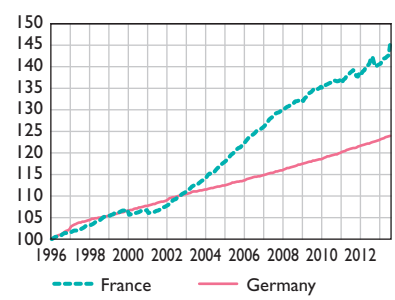
(Q1 1996 = 100)



Sources: Insee (France), Deutsche Bundesbank (Germany).

Chart 3 Evolution of the "rentals" component of the HICP

(Q1 1996 = 100)



Sources: OECD, Insee, Deutsche Bundesbank.

1 *Our study focuses on changes in housing costs. The existing data suggest that housing prices are higher in France, with a difference of around 30-40% in 2012. Until 2002, average purchase prices were higher in Germany. (See "House prices in France and Germany" internal DGEI-DCPM-DIACONJ note, July 2013).*

to their German counterparts. It is thus no coincidence that the issue of house price inflation has sparked intense debate and considerable concern in France.[2]

In this study, we look at the transmission mechanism whereby changes in housing costs are passed through to wage growth via their impact on the general level of prices. Indeed, since housing accounts for a significant proportion of household expenditure, any changes in the cost of housing are liable to have a major impact on the cost of living, which may in turn affect wage claims.

To examine these mechanisms, our study proceeds in three stages. Firstly we give a brief presentation of the channels through which housing costs influence wages, as identified in recent economic literature. We then develop consumer price indices that take into account, in a comparable manner, changes in house prices in both countries, in order to address some of the limitations of traditional indices. In doing so, we will be able to gain a better understanding of how developments in the housing market affect household purchasing power. Finally, in the third section, we use these adjusted price indices to attempt to quantify the impact of changes in the cost of housing on wage growth in both countries.

1| The housing market and wages: the main transmission channels identified in economic literature

The economic literature has identified several mechanisms via which developments in the housing market can impact the labour market in general and wages in particular. In this section, we discuss these mechanisms in a simple and intuitive manner, focusing only on those mechanisms which provide an explanation for the macroeconomic relationship between wages and housing costs. Readers interested in an in-depth analysis of these mechanisms should consult Bover *et al.* (1989).

A first transmission mechanism is the cost-of-living effect, which is the impact of changes in the cost of housing on the cost of living for households. Indeed, since housing accounts for a significant proportion of household expenditure, housing market shocks in a given region, resulting in higher purchase or rental prices, have a direct impact on the standard of living of employees (owners or tenants) and can, therefore, lead to higher wage demands. Numerous empirical studies (see references below) have demonstrated a positive correlation between house prices and wages,

2 *For example, the French Finance Act of 2013 and Conseil d'analyse économique (CAE – French Council of Economic Analysis), Note No. 2* "How should housing prices be moderated?" *by Alain Trannoy and Étienne Wasmer (February 2013).*

and it is reasonable to expect this correlation to be particularly close in countries or sectors where unions are powerful and wages are set through collective bargaining.

A second mechanism likely to lead to a positive relationship between house prices and wages concerns the wealth effect on owner households when the price of their homes rises. These wealth effects can result in increased consumption by these households, which can be regarded as a demand shock, leading to an increase in the demand for labour and potentially positive effects on wages.[3]

A third mechanism relates to the effects of housing costs on the structure of businesses' operating costs (excluding wages). Housing price increases in a given region have a negative effect on the profits of firms located in the region in question, negatively impacting earnings and employment in these companies. Significant housing price shocks may discourage new businesses from setting up in these regions and lead to the migration of companies to other regions. Higher set-up costs, therefore, result in a negative relationship between house prices and wages, offsetting the positive effects identified in the previous paragraphs.[4]

These three mechanisms may thus explain the impact of changes in the housing market on the labour market. However, the causality can also be reversed: changes in the labour market may also affect housing market dynamics. Indeed, if productivity shocks result in higher wages and excess demand in the housing market, this increase in wages may, at least in the short term, lead to increases in housing costs. Studies carried out in the field of economic geography suggest that productivity is higher in large cities, which explains why firms prefer to be located in large cities, in spite of higher housing and wage costs.

As a result, identifying a causal relationship between the housing market and wages is troublesome. Nevertheless it has been demonstrated in several studies. For example, in the case of the United Kingdom, Bover *et al.* (1989) show that wages are positively affected by housing prices with a one-year lag. Other studies based on British data at regional level came up with similar findings. For example, Blackaby and Manning (1992), and Cameron and Muelbauer (2000) conclude that an increase in house prices in a given area leads to an increase in wages of manual workers. Similar studies for the United States, such as Winters (2009), on the basis of a test of the cost-of-living

3 Available studies for France show that these effects exist but are quantitatively weak (Arrondel, Savignac and Tracol, forthcoming; Chauvin and Damette, 2010). Studies using microeconomic data showed positive wealth effects in the United Kingdom (Campbell and Cocco, 2007) and numerous studies have found positive effects in the case of the United States, supporting the macroeconomic evidence (see Gale and Sabelhaus, 1999).

4 A fourth mechanism, often mentioned in papers on the subject, by which the housing market can affect the labour market concerns owner interregional mobility. Indeed, it has been shown that homeowners are less likely to migrate from their residential area when faced with negative shocks to employment, which would generate a positive relationship between the share of owner-occupier housing and structural unemployment, and a negative impact on wages. Thus, Blanchflower and Oswald (2013) show that increases in rates of homeownership in the United States are correlated with lower levels of mobility, greater travel time to get to work and lower company creation rates. See also Oswald (1997, 1999).

theory, identify a positive effect of house prices on regional wages. These last studies use instrumental variables methodology to establish a causal relationship between house prices and wages.

Given the complexity of the relationship between the housing market and wages, this study does not purport to demonstrate a causal link. It aims to provide some descriptive evidence on the subject, allowing an (approximate) quantification of this evidence.

2| The housing market and general price levels: adjusted price indices

Different country-by-country treatment of housing services

The consumer prices index (CPI) reflects the change in the average price of goods and services consumed by households, weighted by their share of average consumption. Housing services make up a significant proportion of household consumption, but their inclusion is complex, especially for households that own their dwelling, as these households consume housing services without any payment, meaning these unpaid-for services are not directly measurable.

Housing services are handled differently across euro area countries, making international comparisons more complicated. For example, the French CPI only includes actual rents (actual expenditure incurred by tenants). Therefore owner-occupier housing is not taken into account in spite of the fact that this group is estimated at 58% for 2010.[5] On the other hand, for owner-occupier housing, the German CPI imputes rents computed according to the characteristics of the housing.[6]

Similarly, the European-level Harmonised Index of Consumer Prices (HICP) only includes actual rents, so as to obtain an index that can be compared across countries. This is not a satisfactory solution and has led the European Commission to call for a harmonised treatment of owner-occupier housing in the HICP.[7] The methodological bases of these new HICPs are under discussion, and the *Technical manual on owner-occupied housing* is currently being drawn up.[8] Implementation dates for these indices are, however, still undetermined.

5 *Depending on whether or not usufructuaries are included in the definition, the percentage of owner-occupier households is estimated at 58% or 55% in France in 2010. For this study, we include usufructuaries in the group of homeowners as they enjoy housing services without payment. Sources:* 2010 Wealth survey *(Insee) and* Eurosystem household finance and consumption network *(2013).*

6 *See Lecat (2003).*

7 *See Commission Regulation (EC) No 93/2013 of 1 February 2013.*

8 *Eurostat (2012). The March 2012 version is available at the following address:* http://epp.eurostat.ec.europa.eu/portal/page/portal/hicp/documents_meth/OOH_HPI/Detailed_Technical_Manual_on_Owner-Occupied_Housing-v2.pdf

From a practical point of view, omitting owner-occupier expenditure from the index reduces the weights of the housing item, resulting in a reduction of the impact of housing prices on the general level of prices measured. This bias is apparent when comparing the German CPI and HICP (the latter excludes imputed rents). Table 1 gives the weights of the "Rentals" item (04.1) for both indices. The proportion of owner-occupier housing is around 44% in Germany (source: Household Finance and Consumption Network or HFCN),[9] which gives housing expenditure weights that are double that of the HICP. The size of the bias induced by the omission of owner-occupier expenditure grows in proportion to the total number of households that owner-occupier dwellings represent.

Table 1 Weights for housing expenditures in the German CPI and HICP

(‰)

	2000	2005	2010
CPI	212	203	210
HICP	115	109	104

Sources: Destatis and Eurostat.

Two approaches for computing housing services are outlined in the Eurostat Manual: *imputed rents* and *net acquisitions*.[10] We review them successively, presenting their principal characteristics, and we provide HICPs adjusted according to each approach. These estimates must be considered as approximate as some of the necessary data are not yet available. We used the HICP as a starting point to achieve comparable series for both countries. Given their methodological proximity, changes in inflation measured by the two types of indices are almost identical in both countries over the period in question.[11]

The imputed rents approach

This approach consists in imputing notional rents onto owner-occupier households for their dwellings. Imputed rents are calculated according to actual rents paid for similar dwellings, under the assumption that they are a good measure of the opportunity cost of living in one's own dwelling. In other words, the household is considered to be paying rent to itself. A weakness of this approach is that it is based on imputed values and not on actual transaction prices.

We use the proportion of owner-occupier households to adjust the weights for housing services (the proportion of owner-occupier housing was 58% for France and 44% for Germany in 2010 – sources: *Institut national de*

9 See Eurosystem household finance and consumption network *(2013).*

10 A third approach is the "Payments" approach. Under this approach, all monetary outlays made by households when buying a dwelling must be included, including mortgage interest and capital repayments. These can hardly be considered as consumer spending, which is why Eurostat does not recommend this method.

11 Housing benefits (APL, ALF and ALS – the three types of housing assistance available in France) reduce the "net" cost of housing, defined as the price paid net of benefits paid by the state. Housing benefits are considered as income (like grants and scholarships, for example) and are not deducted from the price (both in the CPI and in the HICP; see Barret et al., *2003). Insofar as more housing assistance is given by the state in France than in Germany, these benefits have the effect of reducing the difference in housing costs between the two countries, something that is not captured by the price indices.*

Table 2 Weights according to the imputed rents approach

(‰)

	France			Germany	
	Original shares	Adjusted CN shares	Shares adjusted for owner rates	Original shares	Shares adjusted for owner rates
1996	141	315	253	213	324
1997	145	322	258	215	327
1998	147	327	262	216	328
1999	154	348	279	216	328
2000	151	340	271	217	350
2001	146	330	258	217	347
2002	140	323	250	216	346
2003	143	329	256	216	346
2004	144	335	260	218	347
2005	145	335	261	218	346
2006	147	338	263	224	350
2007	148	341	267	227	351
2008	146	341	265	231	352
2009	147	344	266	236	356
2010	150	348	271	230	351
2011	155	352	275	233	353
2012	158	352	276	239	359

Sources: Insee, Destatis, author calculations.

la statistique et des études économiques (Insee – French National Institute of Statistics and Economic Studies and HFCN survey). We also use the imputed rents provided by the *Comptabilité nationale* (CN – French National Accounting) household consumption accounts ("CN share").

Imputed rents for owner-occupier housing are constructed on the basis of rents paid for similar housing on the private rental market. They are representative of the rents prevailing in the private market.[12]

For France, the adjusted weights are up to twice as large as the original ones. They were 12 percentage points higher over the period analysed. The HICP is presented on a quarterly basis in Table A2 in the Appendix, as well as the formulas used and their derivation.[13]

Cumulative inflation in France for the period 1996-2012, as measured by the indices adjusted for the imputed rent weights (see Table 3), is then up to 4 points higher than the original value. The difference between the adjusted index and

12 *They exclude rents paid for social housing. Imputed rents are deflated by the open market rent index averaged over a year from the Rents and Charges Survey. This index incorporates taxes, including lease tax (with exceptions, rents are not subject to VAT). See methodological note on the revision of rents in the housing satellite account and national accounts, CGDD/SOeS (where CGDD refers to the* Commissariat général au Développement durable *or General Commission for Sustainable Development and SOeS to the* Service de l'Observation et des Statistiques *or Observation and Statistics Office), References, Housing accounts, First 2010 results and 2009 accounts, March 2011.*

13 *An alternative method which transposes the weights of housing in the German CPI to the French HICP has also been developed. We have not included it here for reasons of brevity. The results obtained are similar to those presented.*

Table 3 Results obtained with the imputed rents approach

(%)

Q4 1996 – Q4 2012	France (Q4 2005 =100)			Germany (Q4 2005 =100)	
	HICP	Adjusted HICP		HICP	Adjusted HICP
		CN share	Share with owner rates		Share with owner rates
Cumulative inflation	31.27	35.33	33.88	28.65	29.41
Average quarterly inflation	0.43	0.48	0.46	0.39	0.40
Average annual inflation	1.72	1.91	1.84	1.59	1.63

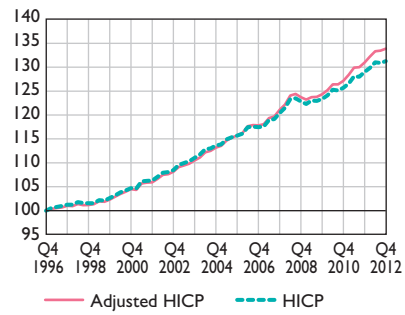
Sources: Insee, author calculations.

the HICP becomes very significant as of 2005 (see Chart 4). For Germany, there is only a 1 point difference.

An alternative way of measuring the cost of living is provided by consumption deflators, which do include imputed rents. Cumulative inflation, computed using consumption deflator growth, was 26 points in France (compared to 22 points in Germany). The differential between France and Germany is 4.45 points, which is very close to that obtained using the imputed rents method (4.47).

Chart 4 French HICP adjusted according to the imputed rents approach (Share with owner rates)

(Q4 1996 = 100)



Sources: Insee, author calculations.

The net acquisitions approach

The net acquisitions approach treats housing as durable goods and is based on the same principles applied to other durable goods, including vehicles. This approach has the support of Eurostat (it is recommended in the Technical Manual on Owner Occupied Housing).[14] According to these principles, expenditures related to the acquisition of dwellings are calculated at the housing market value and are fully imputed at the time of acquisition. The main advantage of this method is that it reflects changes in actual transaction prices, which is consistent with the principles applied to other components of consumer price indices.

This approach requires the inclusion of an additional component taking into account expenditures incurred in the acquisition of dwellings. As recommended by Eurostat (2012), we use the ratio between housing

14 The publication of a price index specific to owner-occupier housing is scheduled for September 2014. The European Commission has set a five-year deadline from September 2014 for the preparation of a report analysing the usefulness of these indices for the application of the acquisitions approach to HICPs (Commission Regulation – EC – No 93/2013 of 1 February 2013).

expenditures and rental expenditures to calculate the weights of this component,[15] using national accounts data (see the details of the weights calculations in the appendix).[16]

In comparison with other consumer durables, there is an additional complication when taking into account expenditures incurred in the acquisition of dwellings in consumer price indices. Buying a property is both a housing services consumption purchase and an investment. In other words, housing is both a consumer good and an asset. However, the calculation of consumer price indices should only include consumption expenditure. A housing unit is made up of a structure built on land. A possible solution to this issue, and one we have adopted here, is to consider that the price of the land represents the investment portion and that the cost of the structure reflects the consumption component.[17]

In practice, however, distinguishing between these two aspects is difficult, as house price indices do not make the distinction between the price of the land and the price of the building. Given this difficulty, we have tried using house price indices that include the value of land, and construction costs indices that exclude the value of land. The results can be interpreted as upper and lower bounds respectively. The series thus obtained are given in the appendix. The changes in weights are shown in Table 4 and the changes in the indices in Table 5.

The results are qualitatively similar to those obtained using the imputed rents approach, but are quantitatively more significant. Due to the very rapid rise in house prices in France over the period considered, using these prices when applying the net acquisitions approach resulted in more pronounced price adjustments.[18]

Table 4 Weights according to the net acquisitions approach

(‰)

	France		Germany	
	Original shares	Adjusted shares	Original shares	Adjusted shares
1996	141	247	213	338
1997	145	254	215	337
1998	147	258	216	339
1999	154	279	216	337
2000	151	272	217	341
2001	146	263	217	327
2002	140	256	216	314
2003	143	262	216	314
2004	144	269	218	313
2005	145	272	218	310
2006	147	281	224	319
2007	148	289	227	325
2008	146	288	231	323
2009	147	271	236	320
2010	150	274	230	318
2011	155	283	233	327
2012	158	282	239	330

Sources: Insee, Destatis, author calculations.

15 The specific price index for owner-occupiers is likely to include, in addition to the value of the dwelling, acquisition, repair, maintenance and insurance costs. The Eurostat website provides details on these indices.

16 As in the case of durables, the weights must be calculated using net household expenditures (purchases less sales between households). Household sales are actually considered as "negative" expenditure, reducing the weights (see ILO, IMF, OECD, Eurostat, United Nations, World Bank, 2004).

17 See ILO, IMF, OECD, Eurostat, United Nations, World Bank (2004).

18 The Eurostat manual recommends the use of price indices of new dwellings, as they exclude transactions between households. We use price indices for existing dwellings as these indices have been published over a longer period for both countries. Calculations carried out with the price indices of new dwellings for France give similar results.

Table 5 Results obtained with the net acquisitions approach

(Q4 2005 = 100)

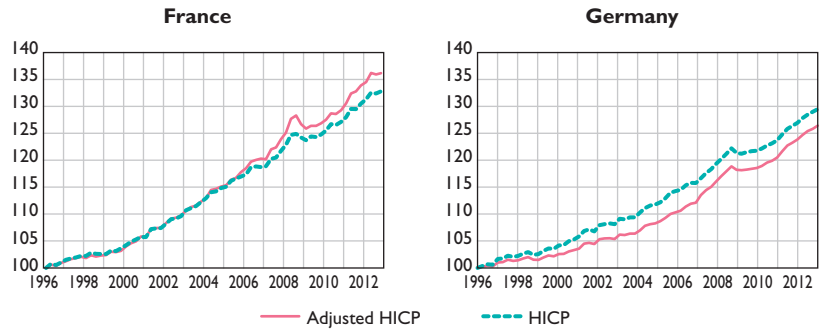
	Cumulative inflation	Average quarterly inflation	Average annual inflation
France			
HICP	31.27	0.43	1.72
Adjusted HICP			
Existing dwellings	40.02	0.53	2.13
New dwellings	38.62	0.51	2.07
Construction costs	34.65	2.07	1.88
House price index used			
Existing dwellings	150.81	1.45	6.09
New dwellings	56.83	0.73	2.88
Construction costs	101.95	1.13	4.55
Germany			
HICP	28.65	0.39	1.59
Adjusted HICP			
Existing dwellings	23.23	0.32	1.32
Construction costs	26.00	0.35	1.46
House price index used			
Existing dwellings	7.57	0.11	0.48
Construction costs	22.40	0.31	1.29

Sources : Insee, Destatis, author calculations.

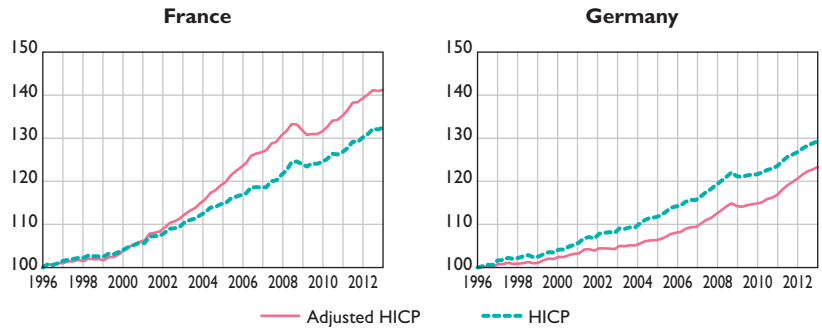
Charts 5 HICP adjusted according to the net acquisitions approach

(Q1 1996 = 100)

a) Construction costs index



b) Price of existing (second-hand) dwellings index



Sources: Insee (France), Deutsche Bundesbank (Germany) and author calculations.

In the case of France, HICPs adjusted in this way (column 2 of Table 5) show cumulative inflation of up to 10 points higher than the unadjusted HICP. The adjustment affects inflation in Germany in the inverse direction: given the small rise in house prices, the adjusted HICP changes more slowly over time than the unadjusted one. The differences are less pronounced when using construction costs indices, but still more significant than those obtained with the imputed rents approach.[19]

3| Changes over time in the cost of housing and wages in France and Germany

We shall now examine the relationship between changes over time in the cost of housing and wages in France and Germany (see Box).

The results are presented in Table 6. Over the period from the final quarter of 1996 to the final quarter of 2012, the cumulative difference in wage growth rates between France and Germany was 25.64 percentage points : $\frac{\Delta w_{FRt}}{w_{FRt}} - \frac{\Delta w_{GERt}}{w_{GERt}} = 25.64$. Assuming unitary elasticities $a_{GER} = a_{FR} = 1$, the cumulative difference in HICP growth rates (unadjusted) was 2.61 percentage points $\frac{\Delta IPC_{FRt}}{IPC_{FRt}} - \frac{\Delta IPC_{GERt}}{IPC_{GERt}} = 2.61$.

This is barely 10% of the wage gap. The share explained by price levels rises to 18% with the HICP adjusted under the imputed rents approach.

When considering the HICP adjusted using the net acquisitions approach, we observe that these indices account for a higher proportion of the wage differential: 34% with the construction costs index, against 65% with the price index for existing dwellings. The inclusion of housing prices in the price indices results in greater price trend differences between the two countries. However, as noted above, the impact of house prices is overstated in these indices due to the inclusion of the investment dimension associated with housing purchases. They must, therefore, be interpreted as an upper bound. The columns in the middle and on the right show the results obtained for the various indexation coefficients. We can see that the biggest differences between these coefficients accentuate the effects studied.[20]

19 Over the period Q4 1996-Q4 2012, construction costs rose by 57% in France and 22% in Germany. Among reasons often cited are the recent proliferation of regulatory standards in France and the possible lack of competition in the sector (Trannoy (A.) and Wasmer (E.), CAE Note No. 2 "How should housing prices be moderated?", February 2013).

20 Expenditure on energy represents a significant portion of housing expenditure. The cost of energy increased much more rapidly in Germany over the period studied: the "Electricity, gas and other fuels" item went up by 32% in Germany and by 12% in France. Energy expenditure is included in the original HICPs. It affects the evolution of both the original and adjusted HICPs. The difference between the lines of Table 6 results from the additional variation explained by the incorporation of owner-occupier housing services expenditure.

Table 6 Cumulative difference in wage growth rates between France and Germany over the period Q4 1996 - Q4 2012

	Share explained by the HICP, using the following indexation coefficients:					
Indexation coefficient • France • Germany	1.00 1.00		0.60 0.20		0.50 0.33	
	in percentage points	%	in percentage points	%	in percentage points	%
Unadjusted HICP	2.61	10	13.03	51	6.18	24
Adjusted HICP (owner rates)	5.05	20	14.80	58	7.53	29
Adjusted HICP (construction costs index)	8.65	34	15.59	61	8.75	34
Adjusted HICP (existing dwellings index)	16.79	65	19.37	76	12.34	48

Note: The table presents simulations obtained from equation (2) (see Box). The total effect is represented by the cumulative effect during the period from the last quarter of 1996 to the last quarter of 2012. The adjusted HICPs follow the approaches developed in Section 3.
Source: Author calculations.

Box

Model used to study the relationship between changes in housing costs and changes in wages

We use a standard economic model on the assumption that wages in each country are affected by prices:

$$\frac{\Delta w_t}{w_t} = a \frac{\Delta IPC_t}{IPC_t} + \mu_t \qquad (1)$$

where w_t *represents wages per capita,* CPI_t *represents the general price level and the term* μ_t *includes the other variables affecting wages per employee at macroeconomic level (productivity, unemployment, etc.). The operator* Δ *indicates a first difference. The variables are expressed in terms of growth rates. The parameter a is an indexation coefficient, in practice an elasticity: it measures the impact of price level changes on the change in wages (for example, unitary elasticity corresponds to total indexation, which means that a 10% increase in prices would result in a 10% increase in wages). We can express the growth rate differential for wages in France and Germany in terms of the growth rate differential for prices, weighted by the indexation coefficient, as follows:*

$$\frac{\Delta w_{FRt}}{w_{FRt}} - \frac{\Delta w_{GERt}}{w_{GERt}} = \left(a_{FR} \frac{\Delta IPC_{FRt}}{IPC_{FRt}} - a_{GER} \frac{\Delta IPC_{GERt}}{IPC_{GERt}} \right) + \left(\mu_{FRt} - \mu_{GERt} \right) \qquad (2)$$

The first term represents the impact of changes in the general level of prices on wages. The second represents the differences in changes for variables such as productivity and unemployment. In our theoretical framework, they are treated as a statistical residual (that is to say, in the variation in wages for the part that is not explained by price levels).

This exercise allows us to quantify the impact of differences in changes in prices on differences in changes in wages. We will use the different indices we have created and compare the results obtained with those from the unadjusted indices, which will give us an idea of the bias brought about where owner-occupier housing is not included in the price index. The results provide us with approximate orders of magnitude.

In order to carry out this exercise, we must choose values for the a_{FR} and a_{GER} indexation coefficients. Our basic model uses unitary elasticities, namely $a_{FR} = a_{GER} = 1$, which correspond to a long-term elasticity. However, in order to gain a better understanding of the role of indexation, we also use medium-term elasticities, corresponding to a period of one year. In order to set the value of these parameters, we rely on the results of existing studies analysing the relationship between the general level of prices and wages in both countries. Numerous studies show a statistical relationship between the general level of prices and wages per capita for France. Cette, Chouard and Verdugo (2012), for example, obtain an indexation coefficient (cumulative over a year) of 60%, based on quarterly data, for the period 1982-2009 (indexation is substantially lower as of 1982; see also Desplatz, Jamet, Passeron and Romans, 2003). In the appendix, we replicate this study using data for the period 1982-2012, and we find similar results, namely an elasticity of 0.57. This leads us to choose 0.6 as a reference value for a_{FR}.

There are fewer studies on the indexation of wages to prices in Germany,[1] but the studies carried out by Peeters and den Riejer (2008, 2014) do offer an assessment. The authors estimate a structural wage equation, which gives elasticities of wages to prices of about 0.2. We take this value as a reference value for a_{GER}.

We also use elasticities derived from wage equation estimates from macroeconomic models. For Germany, the European Central Bank (ECB) model estimate for the German block provides a value of 0.33. The MASCOTTE model provides a value of 0.5 for France. We also use these two values.[2]

1 The wage equation estimate for Germany (equivalent to that presented in the appendix for France) is rendered problematic by the unavailability of long quarterly series (for estimating long-term relationships) and the change in regime which is likely to have occurred following the wage moderation policies applied in the first half of the 2000s.
2 See Vetlov (I.) and Warmedinger (T.) (2006).

4| Conclusion

The competitiveness of the French economy, in which wages are a key component, is central to government concerns and has provoked intense debate in France. Recent years have shown strongly contrasting trends in wages in France and Germany. The cost of housing, which has risen sharply in France as opposed to the relative stagnation in Germany, is often cited to explain the differences in wage curves. The impact of housing costs on the cost of living and purchasing power of households can create pressure on wages. In this article we have tested this hypothesis by constructing indices of consumer prices that incorporate changes in housing expenditure and prices more extensively than the standard indices. On this basis, changes in house prices prove to be a key determinant of changes in wage differentials in France and Germany. In the current debate on economic policies to strengthen French competitiveness, this article confirms the importance that needs to be attached to housing policy.

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Appendix

1 | Construction of the adjusted indices: formulae

The imputed rents approach

Making the assumption that rent structures for tenants and owner-occupiers are the same, tenant expenditures are used to calculate the imputed expenditures of owners.

Weights of X are observed in the unadjusted CPI, calculated from rental expenditures alone (no owner-occupier imputations), and is equal to: X = *total expenditures* x *tenant proportion* where *total expenditures* = *tenant expenditures* + *owner expenditures*.

We can therefore estimate total expenditures using the following formula: *total expenditures* = X/*tenant proportion*.

To arrive at the aggregate value of adjusted indices, we recalculate the weights of expenditures associated with each item, taking into account the increased weights of the housing item, and then apply the changes in value of the index associated with each item.

The "National Accounting" adjustments use the ratio between actual rent expenditures and imputed rents obtained from national accounts data on household final consumption, according to the following formula: *adjusted weights* = *original weights* + *original weights* x *(imputed rents/actual rents)*

The acquisitions approach

We follow the approach proposed by Eurostat (2012, p. 36). The weights of the acquisitions of dwellings item p_{ACQ} are defined according to the following formula:

$$P_{AQC} = \frac{IMAQC}{DMLY} * P_{LOY}$$

where *IMAQ* is household investment in new dwellings and *DMLY* represent household expenditure on rents. We use household investment (institutional sector S. 14+S. 15) on fixed capital (item P. 51) to approximate *IMAQ*. These data are taken from the national accounts. p_{LOY} is the price of housing, measured using the purchase prices of dwellings (existing or new) or with the construction costs index.

To arrive at the aggregate value of the adjusted indices, we recalculate the weights of expenditures associated with each item, taking into account this new item, and then apply the changes in the value of the index associated with each item.

2 | Data sources

Details on house price indices

France

- Existing: quarterly price index of second-hand dwellings – Metropolitan France – All items – Seasonal adjustment series – Insee.

- New: new housing price index, price of apartments – All France – *Commissariat général au développement durable* (CGDD – General Commission for Sustainable Development).

- Construction costs index: producer price index for construction of new residential buildings – Base 2010 – Insee.

Germany

- House price index – Prices for owner-occupied apartments in seven cities – Deutsche Bundesbank – Circulated by the OECD, publication "*House Price Indexes*".

- Construction costs index: Baupreisindizes: Deutschland, Berichtsmonat im Quartal – Destatis. These are the hedonic Laspeyres indices covering Germany.

Details on the harmonised price indices

We use monthly HICP series available on the Eurostat website, which are aggregated quarterly. The series of HICP aggregates are seasonally adjusted.

Details on the data used in wage equations

The data come from the national accounts. The wage measure is an average wage per capita, integrating all components of labour wages. Labour productivity, unemployment and hours worked are calculated for the whole economy and are available in the OECD's Economic Outlook. The series used were seasonally adjusted by data-producing agencies.

3| Wage indexation in France

We present estimates of indexation coefficients for France. These coefficients are obtained by estimating wage equations, namely the relationship between the average wage per capita in the economy and explanatory variables that economic theory has identified as having an effect on wages. Here we replicate one of the models used by Cette, Chouard and Verdugo (2011), using the most recent data (1970-2012). This model adopts a linear relationship between wages and these variables, and results in an autoregressive effect in the dependent variable:

$$\Delta w_t = a + \sum_{j=1}^{3} \gamma_j \Delta w_{t-j} + \sum_{j=0}^{3} a_j \Delta CPI_{t-j} + \beta_1 \, unemployment_t + \beta_2 \Delta \, unemployment_t$$
$$+ \varphi \Delta \, productivity_t + \partial \Delta \, hours_t + TRIM + \mu_t$$

where w is the average wage per employee, *CPI*, the consumer price index, *unemployment*, the rate of unemployment, *productivity*, labour productivity, Δ *hours*$_t$ the increase in hours worked. *TRIM* are dichotomous variables that take into account the recurring quarterly specificities in changes in wages. μ_t is an error term. The variables are expressed in logarithms (except the unemployment rate) and transformed into first differences: for the variable x, the first difference is defined by $\Delta x_t = x_t - x_{(t-1)}$. We allow a dynamic impact of price changes, including three lagged price changes.[1] The results are used to calculate a long-term elasticity of wages with respect to the general price level, defined by:

$$\varepsilon = \frac{\sum_{j=0}^{3} a_j}{1 - \sum_{j=1}^{3} \gamma_j}$$

The results are given in Table A1. Column 1 shows the results for the period 1970-2012 and column 2 for 1982-2012. The long-run elasticities are 0.75 and 0.57 respectively. Our estimates confirm a gradual process of disindexation in France as of 1982. These results are consistent with other studies and corroborate the choice of the parameters used in Section 4.

1 *We have experienced it with the specifications including lags of the dependant variable and all the explanatory variables, obtaining results similar to those presented.*

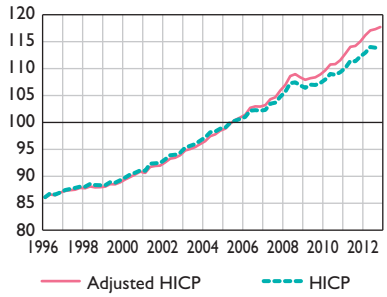
Table A1 Wage equations in France

	1970-2012	1982-2012		1970-2012	1982-2012
	1	2		1	2
d_wage_(t-1)	0.476***	0.456***	d_unemployment	-0.158	-0.155*
	(0.078)	(0.085)		(0.113)	(0.091)
d_wage_(t-2)	-0.151*	-0.094	d_productivity	0.113**	0.206***
	(0.085)	(0.093)		(0.049)	(0.052)
d_wage_(t-3)	0.037	-0.023	d_hours	-0.003	-0.045
	(0.068)	(0.075)		(0.055)	(0.057)
d_CPI_t	0.226***	0.152**	T==2	-0.000	-0.000
	(0.055)	(0.061)		(0.001)	(0.001)
d_CPI_(t-1)	0.237***	0.133**	T==3	-0.001	0.000
	(0.062)	(0.066)		(0.001)	(0.001)
d_CPI_(t-2)	0.006	0.040	T==4	0.001	0.001
	(0.064)	(0.065)		(0.001)	(0.001)
d_CPI_(t-3)	0.012	0.053	constant	0.012***	0.010***
	(0.062)	(0.062)		(0.002)	(0.003)
unemployment	-0.110***	-0.085***	Number of observations	169	125
	(0.021)	(0.026)	R2	0.976	0.956

*The numbers in brackets are standard deviations of the estimated coefficients. ***, ** and * next to a coefficient indicate that it is significant at the respective thresholds of 1%, 5% and 10%.* w *is the average wage per capita,* CPI *is the consumer prices index, unemployment is the unemployment rate, productivity is labour productivity, hours is the increase in working hours, and* TRIM *are dichotomous variables that take into account the recurring quarterly specificities in changes in wages. Variables preceded by "*d_*" indicate a first difference, and the expression in brackets* (t-x) *means the number* x *of lagged changes.*
Source: Author calculations.

French HICP, adjusted CN share Imputed rents

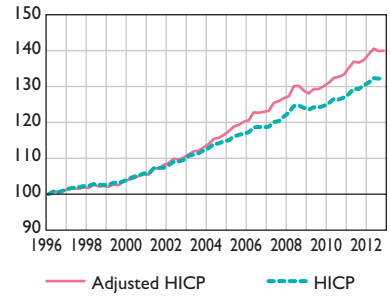
(Q1 1996 = 100)



Sources: Insee, Destatis, author calculations.

French HICP, adjusted acquisitions approach New apartments

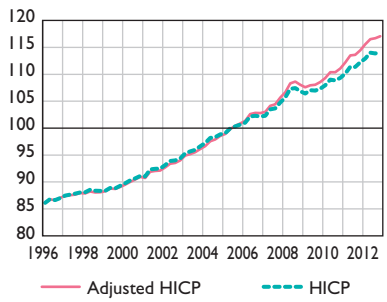
(Q1 1996 = 100)



Sources: Insee, Destatis, author calculations.

French HICP, adjusted share Germany Rents

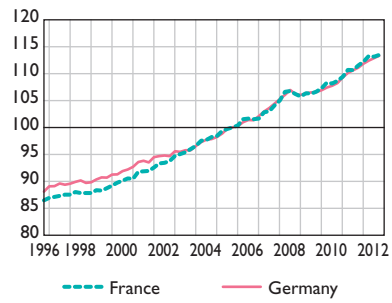
(Q1 1996 = 100)



Sources: Insee, Destatis, author calculations.

Evolution of French and German HICPs

(Q4 2005 = 100)



Sources: Insee, Destatis, author calculations.

Table A2 Evolution of HICPs adjusted according to the imputed rents approach

(base Q4 2005 = 100)

		France			Germany	
		HICP	Adjusted HICP		HICP	Adjusted HICP
			CN share	Share with owner rates		Share with owner rates
1996	T1	85.57	85.98	85.47	87.57	87.76
1996	T2	86.26	86.63	86.15	87.86	88.04
1996	T3	86.06	86.50	85.98	88.13	88.27
1996	T4	86.43	86.97	86.41	88.06	88.32
1997	T1	86.89	87.29	86.73	89.02	89.16
1997	T2	87.09	87.40	86.88	89.09	89.26
1997	T3	87.26	87.52	86.99	89.55	89.73
1997	T4	87.49	87.83	87.27	89.35	89.62
1998	T1	87.49	87.78	87.21	89.52	89.74
1998	T2	87.98	88.11	87.59	89.85	90.03
1998	T3	87.81	87.93	87.41	90.11	90.26
1998	T4	87.78	87.97	87.43	89.68	89.84
1999	T1	87.78	88.07	87.58	89.78	89.85
1999	T2	88.32	88.55	88.10	90.31	90.46
1999	T3	88.24	88.51	88.02	90.71	90.85
1999	T4	88.69	88.86	88.39	90.64	90.74
2000	T1	89.18	89.39	88.93	91.20	90.94
2000	T2	89.73	89.86	89.41	91.27	91.07
2000	T3	90.07	90.33	89.82	91.87	91.71
2000	T4	90.50	90.84	90.30	92.16	92.16
2001	T1	90.44	90.63	90.16	92.66	92.53
2001	T2	91.73	91.76	91.34	93.55	93.36
2001	T3	91.82	91.92	91.47	93.78	93.61
2001	T4	91.88	91.99	91.54	93.49	93.35
2002	T1	92.54	92.57	92.14	94.48	94.21
2002	T2	93.29	93.28	92.86	94.64	94.36
2002	T3	93.40	93.43	92.99	94.78	94.49
2002	T4	93.74	93.90	93.42	94.64	94.39
2003	T1	94.69	94.81	94.28	95.54	95.31
2003	T2	95.04	95.05	94.58	95.44	95.15
2003	T3	95.35	95.42	94.91	95.73	95.50
2003	T4	95.98	95.99	95.49	95.73	95.54
2004	T1	96.59	96.52	96.02	96.53	96.14
2004	T2	97.53	97.44	96.95	97.26	96.80
2004	T3	97.67	97.78	97.21	97.69	97.23
2004	T4	98.19	98.48	97.81	97.82	97.45
2005	T1	98.39	98.85	98.13	98.18	97.90
2005	T2	99.31	99.78	99.05	98.84	98.62
2005	T3	99.69	100.45	99.58	99.74	99.59
2005	T4	100.00	100.00	100.00	100.00	100.00

.../...

Table A2 Evolution of HICPs adjusted according to the imputed rents approach (continued)

(base Q4 2005 = 100)

		France			Germany	
		HICP	Adjusted HICP		HICP	Adjusted HICP
			CN share	Share with owner rates		Share with owner rates
2006	T1	100.35	101.42	100.44	100.20	100.41
2006	T2	101.51	102.73	101.68	100.96	101.16
2006	T3	101.62	102.97	101.87	101.36	101.57
2006	T4	101.52	102.96	101.82	101.32	101.55
2007	T1	101.63	103.19	102.02	102.08	102.38
2007	T2	102.79	104.31	103.15	102.94	103.18
2007	T3	102.99	104.66	103.44	103.57	103.75
2007	T4	104.08	105.93	104.64	104.43	104.62
2008	T1	104.99	106.95	105.58	105.23	105.65
2008	T2	106.58	108.59	107.21	106.05	106.68
2008	T3	106.74	108.97	107.51	106.94	107.55
2008	T4	106.18	108.39	106.93	106.18	106.88
2009	T1	105.72	107.92	106.49	106.05	106.82
2009	T2	106.33	108.22	106.91	106.32	106.88
2009	T3	106.25	108.37	106.97	106.48	106.99
2009	T4	106.63	108.92	107.46	106.55	106.97
2010	T1	107.26	109.67	108.17	106.91	107.40
2010	T2	108.28	110.77	109.24	107.41	107.97
2010	T3	108.14	110.83	109.23	107.74	108.29
2010	T4	108.63	111.56	109.87	108.23	108.84
2011	T1	109.39	112.74	110.95	109.23	110.10
2011	T2	110.69	114.04	112.25	110.09	111.03
2011	T3	110.63	114.19	112.33	110.58	111.51
2011	T4	111.51	115.04	113.19	111.08	112.08
2012	T1	112.21	116.19	114.25	111.84	112.82
2012	T2	113.26	117.09	115.20	112.40	113.35
2012	T3	113.13	117.33	115.33	112.86	113.88
2012	T4	113.45	117.70	115.69	113.29	114.29

Sources: Insee, Destatis, author calculations.

Table A3 Evolution of HICPs adjusted according to the net acquisitions approach – France

(Q4 2005 = 100)

		HICP	Adjusted HICP		
			Existing dwellings	New dwellings	Construction costs
1996	T1	85.57	81.06	83.20	84.98
1996	T2	86.26	81.70	83.93	85.53
1996	T3	86.06	81.50	83.63	85.33
1996	T4	86.43	81.87	84.03	85.80
1997	T1	86.89	81.87	84.35	86.05
1997	T2	87.09	82.18	84.54	86.39
1997	T3	87.26	82.23	84.44	86.54
1997	T4	87.49	82.49	84.75	86.75
1998	T1	87.49	82.25	84.67	86.55
1998	T2	87.98	82.74	85.43	86.96
1998	T3	87.81	82.60	84.96	86.79
1998	T4	87.78	82.67	85.08	86.94
1999	T1	87.78	82.43	84.92	87.01
1999	T2	88.32	83.00	85.49	87.54
1999	T3	88.24	83.05	85.30	87.47
1999	T4	88.69	83.56	86.23	87.67
2000	T1	89.18	84.38	86.54	88.36
2000	T2	89.73	84.95	86.89	88.87
2000	T3	90.07	85.39	87.38	89.17
2000	T4	90.50	85.88	87.85	89.92
2001	T1	90.44	86.16	87.72	89.87
2001	T2	91.73	87.43	89.28	91.12
2001	T3	91.82	87.64	89.11	91.25
2001	T4	91.88	87.85	89.96	91.25
2002	T1	92.54	88.62	90.43	92.01
2002	T2	93.29	89.48	91.41	92.70
2002	T3	93.40	89.81	91.20	92.86
2002	T4	93.74	90.37	91.67	93.21
2003	T1	94.69	91.19	92.46	93.99
2003	T2	95.04	91.82	93.17	94.52
2003	T3	95.35	92.33	93.30	94.77
2003	T4	95.98	93.21	94.10	95.41
2004	T1	96.59	93.94	94.84	95.92
2004	T2	96.59	93.94	94.84	95.92
2004	T3	97.53	95.15	96.03	97.22
2004	T4	98.19	96.57	96.91	97.74
2005	T1	98.39	97.21	97.76	97.96
2005	T2	99.31	98.49	98.86	98.81
2005	T3	99.69	99.29	99.28	99.11
2005	T4	100.00	100.00	100.00	100.00

.../...

Table A3 Evolution of HICPs adjusted according to the net acquisitions approach – France (continued)

(Q4 2005 = 100)

		HICP	Adjusted HICP		
			Existing dwellings	New dwellings	Construction costs
2006	T1	100.35	100.77	100.36	100.62
2006	T2	101.51	102.17	102.15	101.66
2006	T3	101.62	102.61	102.10	101.93
2006	T4	101.52	102.83	102.28	102.13
2007	T1	101.63	103.26	102.53	102.02
2007	T2	102.79	104.48	104.39	103.60
2007	T3	102.99	104.84	104.78	103.88
2007	T4	104.08	106.06	105.45	105.17
2008	T1	104.99	106.88	105.88	106.19
2008	T2	106.58	108.17	108.22	108.35
2008	T3	106.74	108.11	108.35	108.90
2008	T4	106.18	107.09	107.24	107.53
2009	T1	105.72	106.12	106.56	106.82
2009	T2	106.33	106.30	107.60	107.28
2009	T3	106.25	106.27	107.57	107.28
2009	T4	106.63	106.77	108.23	107.66
2010	T1	107.26	107.66	109.03	108.23
2010	T2	108.28	108.81	110.17	109.21
2010	T3	108.14	108.94	110.40	109.14
2010	T4	108.63	109.75	110.93	109.73
2011	T1	109.39	110.83	112.47	110.79
2011	T2	110.69	112.24	113.93	112.34
2011	T3	110.63	112.34	113.69	112.69
2011	T4	111.51	113.06	114.27	113.59
2012	T1	112.21	113.79	115.68	114.12
2012	T2	113.26	114.61	116.93	115.56
2012	T3	113.13	114.44	116.36	115.33
2012	T4	113.45	114.64	116.48	115.52

Sources: Insee, Destatis, author calculations.

Table A4 Evolution of HICPs adjusted according to the net acquisitions approach – Germany

(Q4 2005 = 100)

		HICP	Adjusted HICP	
			Existing dwellings	Construction costs
1996	T1	87.57	92.53	90.69
1996	T2	87.86	92.72	90.90
1996	T3	88.13	92.82	91.05
1996	T4	88.06	92.66	90.91
1997	T1	89.02	93.24	91.59
1997	T2	89.09	93.25	91.64
1997	T3	89.55	93.58	92.06
1997	T4	89.35	93.31	91.84
1998	T1	89.52	93.35	91.94
1998	T2	89.85	93.48	92.26
1998	T3	90.11	93.72	92.49
1998	T4	89.68	93.45	92.06
1999	T1	89.78	93.58	92.03
1999	T2	90.31	94.10	92.43
1999	T3	90.71	94.47	92.75
1999	T4	90.64	94.33	92.64
2000	T1	91.20	94.82	93.00
2000	T2	91.27	94.80	93.03
2000	T3	91.87	95.19	93.42
2000	T4	92.16	95.47	93.68
2001	T1	92.66	95.56	93.91
2001	T2	93.55	96.40	94.73
2001	T3	93.78	96.50	94.88
2001	T4	93.49	96.16	94.67
2002	T1	94.48	96.68	95.49
2002	T2	94.64	96.65	95.61
2002	T3	94.78	96.62	95.66
2002	T4	94.64	96.48	95.52
2003	T1	95.54	97.21	96.27
2003	T2	95.44	97.12	96.19
2003	T3	95.73	97.32	96.43
2003	T4	95.73	97.26	96.44
2004	T1	96.53	97.67	96.98
2004	T2	97.26	98.19	97.73
2004	T3	97.69	98.38	98.02
2004	T4	97.82	98.41	98.14
2005	T1	98.18	98.63	98.51
2005	T2	98.84	99.11	99.05
2005	T3	99.74	99.73	99.72
2005	T4	100.00	100.00	100.00
2006	T1	100.20	100.20	100.26
2006	T2	100.96	100.86	100.99
2006	T3	101.36	101.19	101.46
2006	T4	101.32	101.25	101.63
2007	T1	102.08	101.96	102.90
2007	T2	102.94	102.76	103.74
2007	T3	103.57	103.24	104.28
2007	T4	104.43	104.07	105.18
2008	T1	105.23	104.82	106.06
2008	T2	106.05	105.69	106.92
2008	T3	106.94	106.37	107.73
2008	T4	106.18	105.78	107.16
2009	T1	106.05	105.60	107.06
2009	T2	106.32	105.90	107.19
2009	T3	106.48	106.13	107.31
2009	T4	106.55	106.29	107.44
2010	T1	106.91	106.57	107.79
2010	T2	107.41	107.25	108.36
2010	T3	107.74	107.58	108.65
2010	T4	108.23	108.19	109.21
2011	T1	109.23	109.27	110.29
2011	T2	110.09	110.25	111.24
2011	T3	110.58	110.92	111.68
2011	T4	111.08	111.70	112.23
2012	T1	111.84	112.57	112.99
2012	T2	112.40	113.26	113.65
2012	T3	112.86	113.62	114.03
2012	T4	113.29	114.18	114.54

Sources: Insee, Destatis, author calculations.