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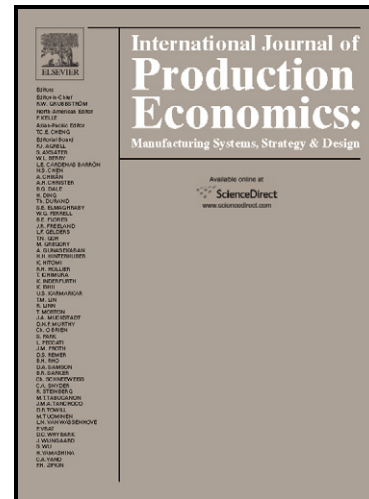
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Abstract

This paper discusses the effects of sectoral structure on the long run macroeconomic inventory behaviour of national economies. Data on fifteen OECD countries are included in the analysis, which is based on correlation and cluster analysis methodologies. The study is part of a long-term research project exploring factors influencing the inventory behaviour of national economies.

First, we introduce some basic characteristics of macroeconomic inventory formation in the fifteen OECD countries. We argue that our previous results on the existence of specific characteristic features of macroeconomic inventory investment are justified, so it makes sense to study the factors influencing those features. We then examine the contribution of various sectors to the production of Gross Value Added in the countries involved and the relationship between sectoral structure and inventory intensity (annual inventory change /Gross Value Added). We find that the high share of agriculture and manufacturing increases inventory intensity, that the increasing share of services has a negative effect and that the role of construction and trade is not obvious. The relatively low stability of the statistical results warns us to be cautious with our judgements. Further, case-by-case analysis would be required to obtain more solid results.

Keywords

national inventories, inventory investment, Gross Value Added, macroeconomic factors, sectoral structure

INVENTORY INVESTMENT AND SECTORAL CHARACTERISTICS IN SOME OECD COUNTRIES

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Introduction

Our paper focuses on some macroeconomic characteristics of the inventory behaviour of national economies. This research field is largely unexplored. There is only one country in which it is adequately studied: the United States, from which a rich set of research results is available (for some recent studies, see Ehemann, 2004, Hirsch, 1996, Humphreys, 2001, Humphreys et al., 2001, Irvine, 2003a, Irvine, 2003b, Irvine, 2005, Irvine-Schuh, 2005, Stern, 2001). There are very few country-specific studies (for exceptions, see Dimelis–Lyriotaki, 2007, Guariglia–Mateut, 2010) and, as logically follows, there are very few cross-country or USA-EU comparisons (Dimelis, 2001, West, 2002). It should be noted, however, that there are interesting and recurring debates about the macroeconomic roles of inventories, especially in connection with business cycles (see Blinder–Maccini, 1991, Lovell, 1994, Chikán–Milne–Sprague, 1994, Dimelis, 2001 or Malgarini, 2007).

Our interest in macroeconomic inventory behaviour dates back to the 1980s. At the First International Symposium on Inventories in 1980, a paper on the effect of the general state of the economy on inventory investment and structure was presented (Chikán, 1981). Since that time, we have largely focused on international comparisons of macroeconomic inventory behaviour. As in the paper by Chikán–Horváth, 1999, we compared trends in 88 countries to determine the connection between the inventory intensity (inventory investment/GDP) of the individual countries and various components of GDP. The current series of papers began in 2003 (Chikán–Tátrai, 2003), when we started to examine data from 14 OECD countries. (The data are probably the most reliable inventory data available). Since that time, we have used the annual inventory investment/GDP ratio to measure national inventory intensity. In the 2003 paper, we analysed the ratio's relationship with various measures and the development, growth and fluctuation of GDP. In our research, we have used regression analyses and multivariable statistical methods. We have examined almost twenty hypothesis and found interesting results, such as the following:

- Inventories relative to GDP tend to decrease in developed countries after the early 1980s;
- The inventory characteristics of developed countries converge;
- However, no general regression model that uses components of GDP usage (fixed capital investment, exports, etc.) as independent variables can be found to describe the inventory behaviour of various countries;
- Even though the tendency of the inventory/GDP ratio to decrease and converge appears to be valid across countries, the reasons for this tendency appear to vary not only by country but also by time period

In this paper, a new dimension of the factors that influence inventory investments is analysed: the sectoral structure of the economy.

In recent years, we have conducted a series of examinations of macroeconomic inventory behaviour using multivariate statistical methods. Results of our research (the special characteristics of which are methodological: we consequently use multivariate statistical methods) have been reported in a series of papers presented at the biannual symposia of the International Society for Inventory Research (ISIR). For the latest paper in the series, with references to earlier papers, see Chikán-Kovács, 2009.

In this paper, we continue in the same methodological tradition, but take a different perspective in our analysis: in earlier papers, we analysed national inventory behaviour in terms of output (GDP use), but we now turn to input for our analysis (GDP production). We take steps to understand the relationship between the sectoral structure of various economies and their inventory behaviour. As stated earlier, we used OECD data for the analysis—this is the relatively richest and most coherent international database for macroeconomic inventory analysis. Even this database has limitations, however, which restricted our options during the analysis.

We believe we have obtained some interesting results even though several of our attempts to find relationships between various sectoral characteristics of the studied economies and their inventories have failed.

Our main hypothesis is that the sectoral structure of economies and changes in this structure influence inventory investments. We test this hypothesis by examining the relationship between the sectoral structure and inventories from various angles.

1. Characteristics of inventory investment in developed countries

The starting point of our analysis was to examine inventory investments in OECD countries where appropriate data were available. The focus of our study is the relative inventory investment, i.e., the proportion of change in inventory level in a given year compared to the Gross Value Added (GVA) of the country in the same year. We wanted to know whether there is a relationship between this figure (which reflects the proportion of GVA invested in inventories in any given year) and the sectoral structure of the economy (measured by the contribution of various sectors to the production of GVA). The relative inventory investment ratio ($IC/GVA = \text{inventory change} / \text{Gross Value Added}$) is positive in the case of increasing inventory and negative in the case of inventory disinvestment.

We had a nearly complete time series of the IC/GVA ratio of fifteen countries from among the most developed economies of the world for the 1987-2007 time period. (There are a few countries for which the time series is a bit shorter, but even for these countries, the time series are no smaller than seventeen subsequent years, a length that is adequate for our analysis.)

It must be mentioned here that, considering the high volatility of inventories, the use of data that is more disaggregated, e.g., a quarterly time series, would greatly increase the importance of our results. Such data are, unfortunately, unavailable in any international data systems, so we had to compromise with annual data.

However, this is not a major problem for our research because we are interested in long-term trends and aggregate behaviour. In fact, registering quarterly movements might have detracted from the long-term view of our work. Therefore, the use of annual data is both a necessity (due to the lack of more frequent registering of inventories in national and international statistics) and an advantage (making it necessary and possible to focus on lasting effects).

Figure 1. Changes in inventory per Gross Value Added (%) 1987-2007

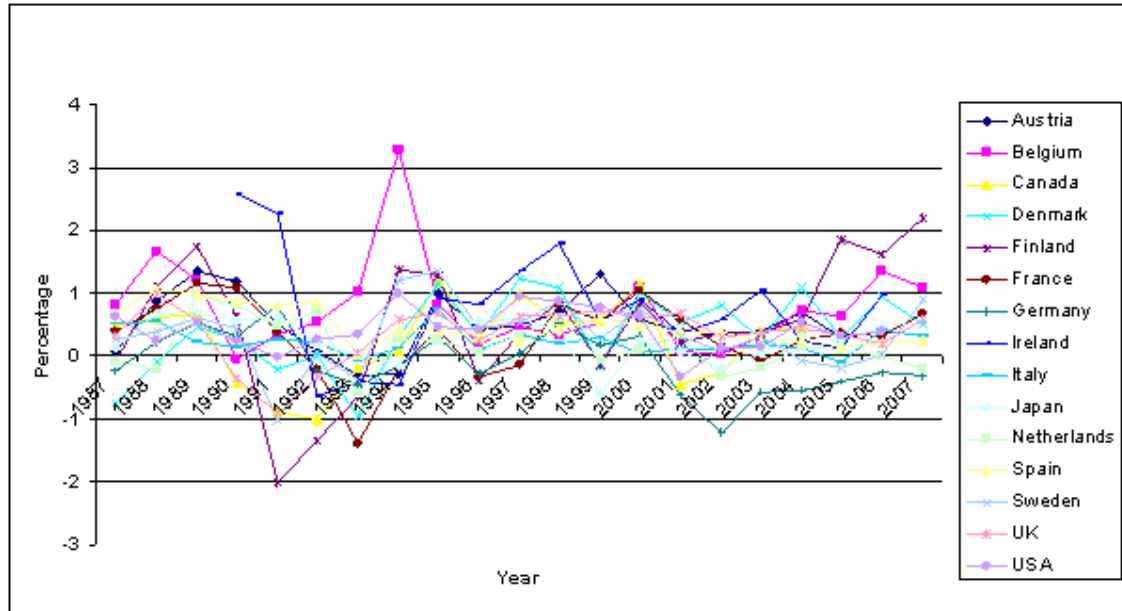
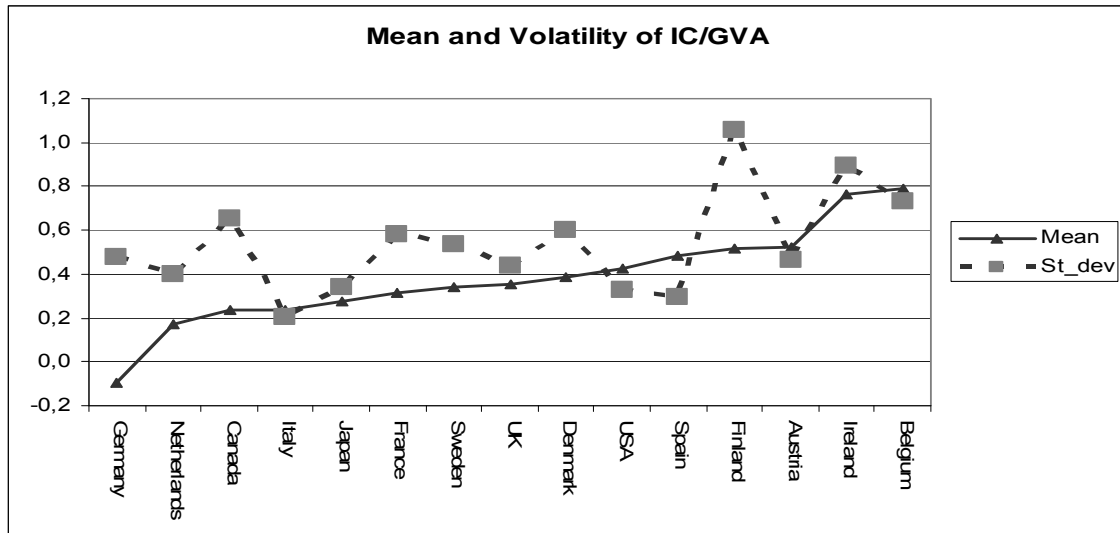


Figure 1 shows the graph of the IC/GVA ratio of all fifteen countries. It can be seen that although the IC/GVA ratio varies substantially by year in each country, the changes remain in a well-definable range that shows a tendency of getting narrower over time. This is an illustration of the tendency that we discussed in an earlier paper (Chikán et al 2005); namely, that in every country, there exists a kind of “normal” level of inventories around which the annual data fluctuate (for an explanation of such norms, see Kornai, 1980). It is a very interesting discovery that these norms seem to converge in the developed countries. It is also noteworthy that these normal levels have no clear tendency towards decline despite the much-celebrated improvements in companies’ inventory management. It appears that the analysis in Chikán (1994) still holds true.

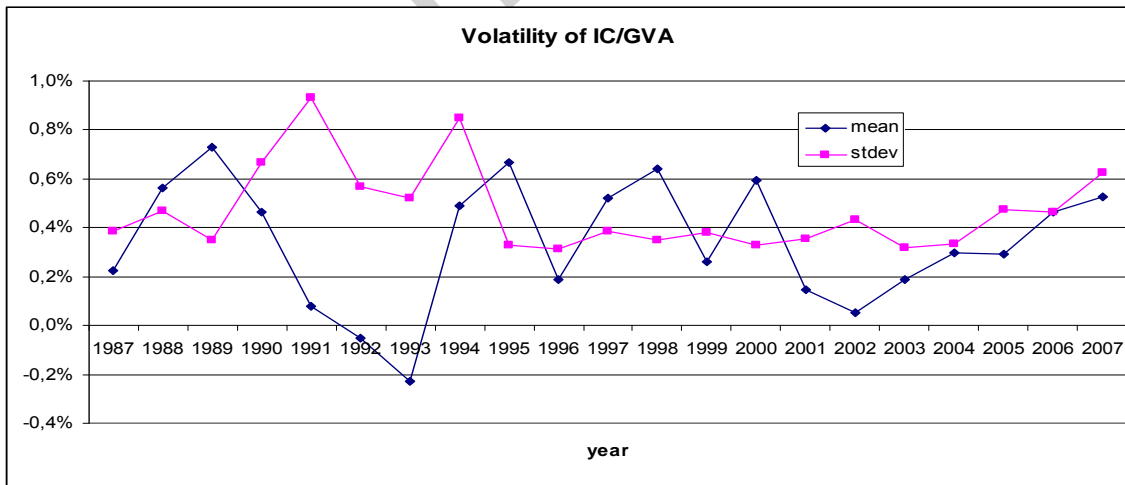
Figure 2 shows the long-term averages (the “norms”) of the individual countries and their volatility over the 21 years in the sample. Countries in the figure are arranged in an increasing order of IC/GVA. There are no outliers. Only Germany had a negative average, which was due to its serial inventory disinvestments in the new millennium. The total range of the IC/GVA ratios is .884 (excluding Germany, .615). The overall average is .382, which can be considered the median value as well. The variance was relatively low in Italy, Japan, the USA and Spain, and relatively high in Finland, Ireland and Belgium.

Figure 2. Mean and volatility of IC/GVA by country (%), 1987-2007



We have examined the yearwise averages as well. Figure 3 shows the mean and the volatility of the IC/GVA data of the 15 countries annually in graphical form. The averages fluctuate (the range is between -.26 and .84, so the averages are rather small). The annual range is rather steady, with the exception of a few years in the early 1990s, when it was substantially higher. The overall picture supports our opinion that developed countries' inventory investment norms are similar.

Figure 3. Mean and volatility of the IC/GVA ratio by years, 1987-2003.



2. Sectoral structure and inventory intensity

Next, we analysed the sectoral structure of the fifteen countries in terms of the various sectors' contribution to the Gross Value Added. For the analysis, we first selected five sectors: agriculture, manufacturing, construction, trade (wholesale + retail) and services. We then selected six subsectors from the manufacturing industry: food, chemicals,

metallurgy, machinery, electronics and transport vehicles. The detailed results are shown in tables in Appendix 1 and 2. Countries are sorted by their average IC/GVA ratios in ascending order. We assigned two different values to each country. The first row (1987-2003) shows the long-term average contribution of that industry to the country's Gross Value Added. The second row (Change) shows the ratio of the last five years' (1999-2003) contribution and the first five years' (1987-1991) contribution to Gross Value Added. These ratios provide insight to the dynamics of structural processes: we can see how the importance of certain industries changed during the period of our investigation. For example, at the end of the period, the contribution of agriculture to Gross Value Added in Germany was 78% of the contribution at the beginning of the investigated period.

We examined the relationship between inventory intensity (the IC/GVA ratio) and the sectoral structure of the 15 countries in the period of 1987-2003 with a correlation analysis. As inventories constantly increased during the past 20 years on average, a positive significant correlation between certain industries' structure and the IC/GVA ratio would suggest that these industries are more intensive in terms of inventories. We analysed this in two steps. First, we analysed the major industries of agriculture, manufacturing, construction, trade and services. In the second step, we looked at certain manufacturing sub-industries, namely food, chemicals, metallurgy, machinery, electronics and transport vehicles.

The results of the correlation analysis between the annual proportion of various sectors' contribution to GVA and countries' IC/GVA ratio can be seen in Table 1.

Table 1. Correlations between the IC/GVA ratio and sectoral structure (15 countries, 1987-2003)

	Agriculture	Manufacturing	Construction	Trade	Services	
Pearson	0.130*	0.187**	0.018	0.064	-0.209**	
Sig. (2-tailed)	0.039	0.003	0.776	0.311	0.001	
N	251	251	251	251	247	
	Food	Chemicals	Metallurgy	Machinery	Electronics	Transport vehicles
Pearson	0.115	0.172**	0.076	-0.103	0.128*	-0.052
Sig. (2-tailed)	0.070	0.007	0.232	0.108	0.045	0.416
N	247	247	247	246	246	247

* Correlation is significant at the 0.05 level (2-tailed)

** Correlation is significant at the 0.01 level (2-tailed)

Unfortunately, even the significant correlations are not very strong. This can be explained by the different nature of volatility of the two sets of data. While the sectoral structure does not change rapidly in the short term, but instead changes incrementally, the IC/GVA ratio may show greater yearly differences and one can find visible trends only in the long run. Nevertheless, these results suggest that the main industries of manufacturing and agriculture are prime candidates for differences in inventory intensity. From the manufacturing sub-industries, the chemicals and electronics industries seem to be the most important. Not surprisingly, the services industry correlates significantly and negatively with the IC/GVA ratio.

If one compares the contribution of various main sectors to the production of GVA in the first and last five countries in the table in Appendix 1 (i.e., the least and most inventory-intensive national economies), the following observations can be made. In those countries where the IC/GVA ratio is low,

- the contribution of manufacturing, agriculture and construction to the GVA is relatively lower, and
- the proportion of services and trade is relatively higher than in the countries with the highest IC/GVA ratios. See Table 2 for a summary.

Table 2. Average contribution of the main industries to GVA (the five least and five most inventory-intensive countries, 1987-2003)

Means	Agriculture	Manufacturing	Construction	Trade	Services
Low IC/GVA countries	2.51	20.88	6.10	12.42	45.31
High IC/GVA countries	4.13	22.44	6.53	11.53	41.35

This indicates that manufacturing, agriculture and construction are generally more inventory-intensive than trade and services. We believe that the relatively higher proportion of trade in the low-inventory countries may also be a consequence of the favourable overall effects of a more extended trade sector on the economy.

If we further analyse the long-term contribution of the various sectors to the GVA by year, we can say that, in accordance with our expectations, the overall contribution of manufacturing, construction and agriculture (the inventory-intensive sectors) to the GVA decreases over time. For more details, see the tables in Appendix 3 and 4 at the end of the article. An important explanation for these trends is the dramatic growth of the service sector, the inventory intensity of which is fundamentally lower than that of other sectors. It should be added that the country-wise range of the proportion of the various sectors under examination either decreases substantially (in the case of agriculture and construction) or stagnates (in the case of trade and manufacturing—though the latter seems to increase slightly in the last few years). This phenomenon supports our hypothesis on the decreasing differences between the “inventory norms” of developed countries.

3. Cluster analysis of sectoral effects

We have executed cluster analysis of the fifteen countries to examine the common characteristics of those countries that have a similar sectoral structure in given years. We put over 300 items of data (on 17 countries for 21 years) into the space of the four main sectors that we considered most important for inventory investment: agriculture, manufacturing, construction and trade. (Services were excluded because their share of total inventories is very low). We used a Two-Step Cluster Analysis procedure, which has very favourable characteristics for our purposes. It is an exploratory tool designed to reveal natural groupings (or clusters) within a dataset that would otherwise not be apparent. The algorithm employed by this procedure has several desirable features that differentiate it from traditional clustering techniques.¹

¹ - Handling of categorical and continuous variables: By assuming variables to be independent, a joint multinomial-normal distribution can be placed on categorical and continuous variables.

After running the cluster analysis, we obtain four clusters of more or less the same size. They contain 80% of the data in our database. Table 3 shows the cluster characteristics.

Table 3. Cluster characteristics

Cluster Distribution			
	N	% of Combined	% of Total
Cluster 1	67	26.4%	21.3%
Cluster 2	71	28.0%	22.5%
Cluster 3	60	23.6%	19.0%
Cluster 4	56	22.0%	17.8%
Combined	254	100.0%	80.6%
Excluded Cases	61		19.4%
Total	315		100.0%

Table 4. Cluster centroids

		AGRICULTURE		TRADE		CONSTRUCTION		MANUFACTURING	
		MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV	MEAN	STD DEV
CLUSTER	1	4.31	2.43	11.92	1.35	6.19	1.16	22.89	3.77
	2	2.74	1.13	12.00	1.37	5.89	1.35	19.95	3.08
	3	2.17	0.86	11.52	1.28	5.80	1.40	19.72	4.67
	4	2.72	1.07	12.01	1.38	5.58	1.31	19.85	2.30
	COMBINED	3.02	1.72	11.87	1.35	5.88	1.31	20.65	3.79

Table 4 shows the cluster centroids. In general, the clusters look very similar, though we can find some distinct characteristics. Cluster 1 members have the highest shares in the agriculture, construction and manufacturing industries, while trade seems to be average. Cluster 2 members are average in all main industries. Cluster 3 members have below-average shares in agriculture and trade. Cluster 4 members are almost identical to Cluster 2 members, aside from the lower share in construction.

For stronger statistical support, we conducted one-way ANOVA analysis to determine which industries are significantly different in the clusters. We found that the two industries that are significantly different in the four clusters are agriculture and manufacturing, so Cluster 1 members have an above-average share of agriculture and manufacturing, while Cluster 3 members have a below-average share in agriculture. The differences in construction and trade are not significant at the .05 level.

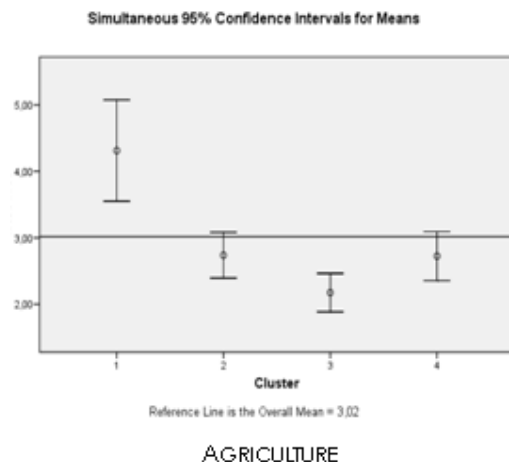


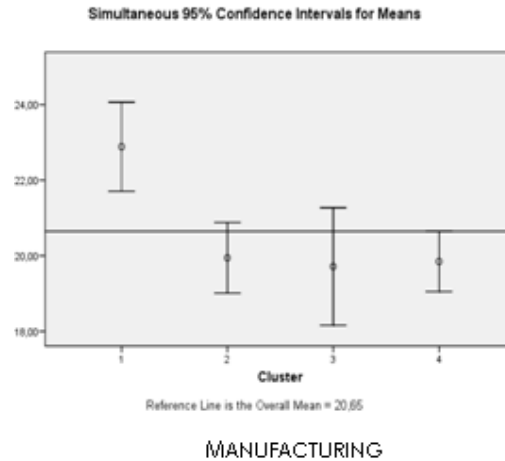
Figure 4. Cluster averages and means for agriculture and manufacturing (%)

ie values of a model-choice criterion across different clustering

nal number of clusters.
(Source: SPSS 15.0 for Windows – Help – Algorithms)

Figure 4 graphically displays the significant sectors of agriculture and manufacturing. The upper and lower limits equal the mean $\pm 2x$ standard error, respectively. The horizontal line is the combined average.

There are no extreme outlier data in the clusters; this fact is consistent with our previous results (Chikán-Kovács, 2009), according to which the OECD countries share similar inventory behaviour.

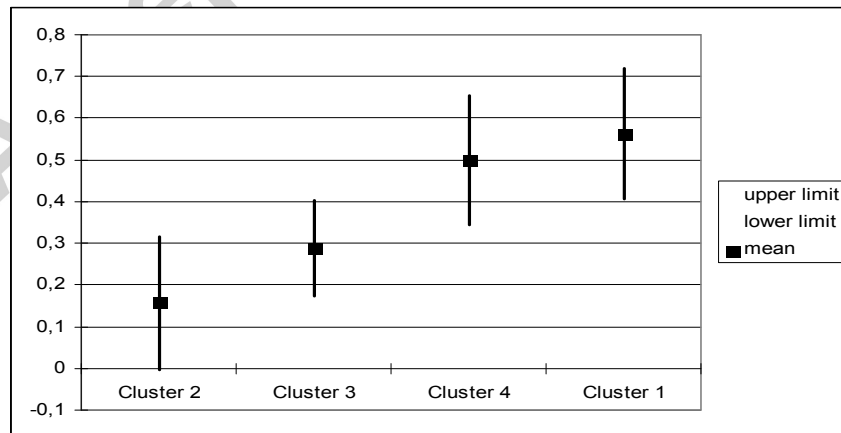


An important step in our analysis is the examination of the four clusters from the point of view of inventory characteristics. Table 5 and Figure 5 show the results. Cluster 2 members have the lowest mean value, with Cluster 3, Cluster 4 and Cluster 1 following: The first two are below the long term average and the second pair is above it.

Table 5. IC/GVA characteristics of clusters

Cluster	Mean	St_error	Upper limit	Lower limit
Cluster 1	0.5625	0.079	0.7205	0.4045
Cluster 2	0.1566	0.08	0.3166	-0.0034
Cluster 3	0.2886	0.057	0.4026	0.1746
Cluster 4	0.4984	0.078	0.6544	0.3424

Figure 5. IC/GVA characteristics of clusters



We are also interested in the structure of the various clusters, which is shown in Table 6 and Table 7. The former contains the country-wise structure of the clusters (it shows how many years' data from the given countries can be found in a cluster), while Table 7 contains the information on which years' data are included in the clusters.

Table 6. Cluster members by country

		Clusters				Total
		1	2	3	4	
Country	Austria	4	5	4	4	17
	Belgium	4	5	4	4	17
	Canada	4	5	3	4	16
	Denmark	4	5	4	4	17
	Finland	4	5	4	4	17
	France	4	5	4	4	17
	Germany	4	5	4	4	17
	Ireland	11	1	5	0	17
	Italy	4	5	4	4	17
	Japan	4	5	4	4	17
	Netherlands	4	5	4	4	17
	Spain	4	5	4	4	17
	Sweden	4	5	4	4	17
	UK	4	5	4	4	17
	USA	4	5	4	4	17
Total		67	71	60	56	254

The results displayed in Table 6 are very interesting. The countries' data are almost evenly distributed among clusters (except Ireland) and the clusters are very stable in time. This means that the sectoral differences are not important in determining into which cluster a particular country falls in a given year.

Table 7. Cluster members by year

		Clusters				Total
		1	2	3	4	
Year	1987	15	0	0	0	15
	1988	15	0	0	0	15
	1989	15	0	0	0	15
	1990	15	0	0	0	15
	1991	1	14	0	0	15
	1992	1	14	0	0	15
	1993	1	14	0	0	15
	1994	1	0	0	14	15
	1995	1	0	0	14	15
	1996	1	0	0	14	15
	1997	1	0	0	14	15
	1998	0	15	0	0	15
	1999	0	14	1	0	15
	2000	0	0	15	0	15
	2001	0	0	15	0	15
	2002	0	0	15	0	15
	2003	0	0	14	0	14
Total		67	71	60	56	254

The time-wise structure of clusters shows a picture that is very different from the country-wise one. It suggests cycles in the effect of sectoral structure on inventory investment: 1987-1990 (four years), 1991-1993 (three years), 1994-1997 (four years), 1998-1999 (two years) and 2000-2003 (four years). Cluster 1 is dominated by data from 1987-1990 (in that cycle, inventory investments were higher than average and agriculture and manufacturing had significantly larger than average weight; see Table 7). Table 8 also showed that Cluster 1 was the most inventory intensive cluster, a fact that fits the sectoral characteristics. In Cluster 2, there are members from two different shorter time periods (1991-1993 and 1998-1999) and Cluster 4 contains data from 1994-1997. Cluster members have a below average weight of manufacturing and agriculture, and these clusters show a smooth transition to Cluster 3 in terms of sectoral structure. Cluster 3 is dominated by data from 2000-2003, and both the manufacturing and agriculture industries have their lowest average share in the sectoral structure. If we refer to Table 8 again, we can see that Clusters 2 and 3 have below average inventory intensities, and that between two periods of Cluster 2, Cluster 4 has above average intensity. The low inventory intensity of Cluster 3 can be easily explained because it has the lowest shares of agriculture and manufacturing (the most inventory-intensive industries) in the sectoral structure. Unfortunately, this phenomenon alone does not explain the difference between Clusters 2 and 4 because the sectoral structures are very similar on average in these clusters.

Summarising our findings, Table 7 shows a trend of movement of the countries from Cluster 1 to Cluster 3 via Clusters 2 and 4. The proportions of agriculture and manufacturing are the highest in Cluster 1 and are the lowest in Cluster 3; the other two clusters represent transitional periods.

4. Sectoral and national inventory investments

Tables 8 and 9 display sectoral inventory investment data for the six countries.

Table 8. Average contribution to GVA%

Country	Sector	Agriculture	Manufacturing	Construction	Trade
Austria		2.92	20.23	7.57	13.36
Finland		4.64	23.60	5.95	10.51
Ireland		6.84	29.21	6.84	10.27
Italy		3.21	21.77	5.39	13.55
The Netherlands		3.47	17.20	5.70	13.22
United Kingdom		1.52	19.95	5.56	11.45
Average		3.77	21.99	6.17	12.06

Table 9. Sectoral inventory intensity (in % of the industrial VA)

Country	Sector	Agriculture	Manufacturing	Construction	Trade
Austria		5.76	.60	.09	1.65
Finland		-1.49	1.06	-.10	-.34
Ireland		.15	1.74	NA	3.29
Italy		.97	1.51	NA	NA
The Netherlands		1.04	.89	.04	.11
United Kingdom		.42	-.36	.58	1.97
Average		.22*	.96	.15	1.74

* without Austria

The Netherlands is second in the overall (15 countries) ranking of countries in terms of inventory effectiveness. This position is at least partly a consequence of the fact that out of the four sectors, only trade's ratio is higher than average, and this sector has performed remarkably well. Italy's position cannot be discerned due to lack of data. The UK has the third lowest level of long-term inventory investment. This is closely connected to the unique feature that the UK has decreased its manufacturing inventories, and manufacturing is usually the largest contributor to increasing inventory investments. The other three countries all belong to the high inventory intensity category. In case of Finland, this can be explained by the high ratio of manufacturing to GVA, especially because it is anecdotally known that within manufacturing the industries with the highest average inventories are dominant (electronics and machinery). As was seen in the cluster analysis, Ireland behaves rather irregularly compared to the other countries, though that countries the relatively high inventory investments can be attributed to the high proportion of manufacturing (the highest in the group). This is not compensated by a large weight of agriculture because its agricultural inventories are relatively low. We could not find any explanation for the high inventory investments in Austria because, according to detailed data, both the sectoral structure and the sectoral inventory intensity should have led to a lower long-term average.

Conclusion

The relationship between economic sectors and the ratio of inventory investment per Gross Value Added in developed countries is not at all straightforward. We made many various calculations that exposed some characteristics of that connection, but a number of questions remain unanswered. The hypothesis that there is a relationship between sectoral structure and inventory intensity can be accepted – it has been proven by our cluster analysis results and the correlation analysis as well. We can also say that the higher the proportion of manufacturing and agriculture in the production of GVA, the higher the inventory intensity of the country. We cannot make similarly definite statements about the role of construction and trade. Within manufacturing, the chemical, mechanical, metallurgy and electronics industries are important: their major share leads to a relatively higher inventory level. The analysis also supports the otherwise trivial conclusion that the main factor lowering inventories in the long run is the increasing share of services.

We did not find any significant correlation between annual changes in inventory investments and sectoral structure. This is not surprising because structural changes have longer-term features than the factors that change annual inventories. However, it is shown that, in the long run, sectoral changes do accompany changes in inventory behaviour. For more conclusive results, further research, including the examination of national case studies, is required.

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Appendix 1. Contribution of the four main sectors to Gross Value Added and its change (%)

		Agriculture	Manufacturing	Construction	Trade	Services
Germany	1987-2003	1.32	24.67	5.69	10.36	48.13
	Change*	0.78	0.76	0.88	1.07	1.19
Netherlands	1987-2003	3.47	17.20	5.70	13.22	46.75
	Change*	0.61	1.06	0.71	0.90	1.14
Canada	1987-2003	2.69	17.88	5.70	11.34	45.26
	Change*	0.78	1.08	0.78	0.95	1.03
Italy	1987-2003	3.21	21.77	5.39	13.55	40.84
	Change*	0.78	1.08	0.78	0.95	1.17
Japan	1987-2003	1.86	22.88	8.04	13.63	43.55
	Change*	0.60	0.91	0.93	0.94	1.22
France	1987-2003	3.17	18.99	5.81	10.70	50.97
	Change*	0.75	0.86	0.82	0.93	1.13
Sweden	1987-2003	2.60	20.93	5.01	10.78	47.59
	Change*	0.78	0.76	0.88	1.07	1.11
UK	1987-2003	1.52	19.95	5.56	11.45	45.44
	Change*	0.53	0.72	0.85	1.08	1.20
Denmark	1987-2003	3.40	16.67	5.01	12.68	49.29
	Change*	0.60	0.91	0.93	0.94	1.04
USA	1987-2003	1.33	16.35	4.22	13.04	52.67
	Change*	0.61	0.84	1.04	0.98	1.08
Spain	1987-2003	4.49	19.12	7.97	11.33	38.58
	Change*	0.75	0.86	0.82	0.93	1.12
Finland	1987-2003	4.64	23.60	5.95	10.51	41.32
	Change*	0.61	1.06	0.71	0.90	1.09
Austria	1987-2003	2.92	20.23	7.57	13.16	40.99
	Change*	0.52	0.94	1.12	0.95	1.11
Ireland	1987-2003	6.84	29.21	6.84	10.27	36.46
	Change*	0.60	0.84	0.93	0.93	1.05
Belgium	1987-2003	1.75	20.05	5.08	12.20	45.91
	Change*	0.60	0.84	0.93	0.93	1.14

* Change is the ratio of the averages of the last five (1999-2003) and first five years (1987-1991).

Appendix 2. Contribution of the six manufacturing sub-sectors to Gross Value Added and its change (%)

		Food	Chemicals	Metallurgy	Machinery	Electronics	Transport vehicles
Germany	1987-2003	2.19	3.90	3.24	3.61	3.71	3.34
	Change*	0.87	0.76	0.75	0.79	0.67	0.89
Netherlands	1987-2003	3.18	3.49	1.99	1.29	1.70	0.78
	Change*	0.98	0.75	0.71	0.91	0.69	0.95
Canada	1987-2003	2.39	2.61	2.22	1.14	1.24	2.64
	Change*	0.89	0.97	1.03	1.20	0.95	1.48
Italy	1987-2003	2.25	3.00	3.02	2.51	2.07	1.33
	Change*	0.87	0.86	0.82	0.88	0.77	0.81
Japan	1987-2003	2.55	3.32	2.95	2.25	4.13	2.38
	Change*	0.85	0.95	0.64	0.72	0.83	0.92
France	1987-2003	2.69	3.34	2.54	1.50	2.25	2.02
	Change*	0.89	1.01	0.84	0.76	0.82	1.16
Sweden	1987-2003	1.82	2.75	2.85	2.66	2.38	2.76
	Change*	0.97	1.25	0.94	1.06	1.04	1.05
UK	1987-2003	2.75	3.49	2.24	1.68	2.47	2.04
	Change*	0.73	0.72	0.64	0.69	0.74	0.73
Denmark	1987-2003	3.01	2.46	1.73	2.41	1.71	0.61
	Change*	0.80	1.21	0.99	0.90	1.13	0.68
USA	1987-2003	1.73	2.76	1.82	1.19	2.25	2.02
	Change*	0.87	0.90	0.78	0.74	0.83	0.80
Spain	1987-2003	3.16	3.12	2.32	1.22	1.43	2.06
	Change*	0.69	0.84	0.89	0.91	0.74	0.92
Finland	1987-2003	2.27	2.58	2.55	2.74	3.68	1.01
	Change*	0.64	0.99	1.06	0.96	2.87	0.75
Austria	1987-2003	2.24	2.35	3.16	2.29	2.53	1.13
	Change*	0.80	0.94	0.91	1.03	0.98	1.46
Ireland	1987-2003	6.24	8.68	0.90	1.06	5.91	0.49
	Change*	0.73	2.68	0.59	0.49	1.47	0.68
Belgium	1987-2003	2.63	4.75	3.07	1.28	1.65	1.90
	Change*	0.88	1.02	0.68	0.79	0.81	0.77

* Change is the ratio of the average of the last five (1999-2003) and first five years (1987-1991).

Appendix 3. Average proportion of the contribution of the main sectors to GVA production, 1987-2003

	Agriculture	Manufacturing	Construction	Trade	Services*
Germany	1.32	24.67	5.69	10.36	48.13
Netherlands	3.47	17.20	5.70	13.22	46.75
Canada	2.69	17.88	5.70	11.34	45.26
Italy	3.21	21.77	5.39	13.55	40.84
Japan	1.86	22.88	8.04	13.63	43.55
France	3.17	18.99	5.81	10.70	50.97
Sweden	2.60	20.93	5.01	10.78	47.59
UK	1.52	19.95	5.56	11.45	45.44
Denmark	3.40	16.67	5.01	12.68	49.29
USA	1.33	16.35	4.22	13.04	52.67
Spain	4.49	19.12	7.97	11.33	38.58
Finland	4.64	23.60	5.95	10.51	41.32
Austria	2.92	20.23	7.57	13.16	40.99
Ireland	6.84	29.21	6.84	10.27	36.46
Belgium	1.75	20.05	5.08	12.20	45.91

* Finance, insurance, real estate, business, community, social and personal services

Appendix 4. Change of the proportion of the main sectors in GVA* production

	Agriculture	Manufacturing	Construction	Trade	Services*
Germany	0.78	0.76	0.88	1.07	1.19
Netherlands	0.61	1.06	0.71	0.90	1.14
Canada	0.78	1.08	0.78	0.95	1.03
Italy	0.78	1.08	0.78	0.95	1.17
Japan	0.60	0.91	0.93	0.94	1.22
France	0.75	0.86	0.82	0.93	1.13
Sweden	0.78	0.76	0.88	1.07	1.11
UK	0.53	0.72	0.85	1.08	1.20
Denmark	0.60	0.91	0.93	0.94	1.04
USA	0.61	0.84	1.04	0.98	1.08
Spain	0.75	0.86	0.82	0.93	1.12
Finland	0.61	1.06	0.71	0.90	1.09
Austria	0.52	0.94	1.12	0.95	1.11
Ireland	0.60	0.84	0.93	0.93	1.05
Belgium	0.60	0.84	0.93	0.93	1.14

* Ratio of five year average annual proportions between (1999-2003) and (1987-1991)

** Finance, insurance, real estate, business, community, social and personal services