

News Release

e-stats service



Date: 15 December 2005
No. : 269/2005
Time of release: 11.00 hrs

National Accounts

Seasonally adjusted GDP 2000-2005 Q3

It is often necessary in interpreting quarterly time series to recognise and take account of the element of variation due to seasonal and other types of calendar influences. Consequently, many economic series display an observable component consisting of a fairly constant shape repeated at a particular frequency (for example, every four quarters). Seasonal effects usually reflect the influence of the seasons themselves, either directly or through production series related to them (such as farm production), or social conventions (such as the incidence of holidays), or administrative practices (such as the timing of tax payments).

There are at least four, not totally distinct, classes of causes of seasonal fluctuations in economic data:

Theme:
Economy and Finance

A. Calendar

The timing of certain public holidays, such as Christmas and Easter, clearly affect some series, particularly those related to production. Many series are recorded over calendar months, and as the number of working days varies considerably from one month to another, in a predetermined way, this will cause a seasonal movement in flow variables, such as imports or production. The working days problem could also lead to spurious correlation between otherwise unrelated series.

B. Timing decisions

The timing of school vacations, the ending of university sessions, the payment of company dividends, the choice of the end of a tax year or accounting period are all examples of decisions made by individuals or institutions that cause important seasonal effects, as these events are inclined to occur at similar times each year. They are generally deterministic, or pre-announced, and are decisions that produce very pronounced seasonal components in series such as employment rates. These timing decisions are generally not necessarily tied to any particular time in the year, but by tradition have become so.

C. Weather

Actual changes in temperature, rainfall, and other weather variables have direct effects on various economic series, such as those concerned with agricultural production, construction and transportation, and consequent indirect effects on other series. It could be argued that these climatic factors represent the true seasonal effect.

D. Expectations

The expectation of a seasonal pattern in a variable can cause an actual seasonal effect in that or some other variable, since expectations can lead to plans that then culminate in seasonality. An example is toy production in expectation of a sales peak during the Christmas period. Without the expectation-planning aspect, the seasonal pattern may still occur but might be of a different shape or nature. Expectations may arise because it has been noted that the series being considered has in the past contained a seasonal pattern, or because it is observed that acknowledged causal series have a seasonal component.

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Other theoretical considerations

These four groups may be thought of as basic causes. Some series may have seasonal components which are only indirectly due to these basic causes. For example, weather may cause a seasonal pattern in grape production which then causes a seasonal distribution in grape prices. For many series, the actual causation of a seasonal effect may be due to the impact of a complicated mix of basic causes as well as a multitude of indirect outcomes via other economic variables. Even if only a single basic cause is operating, the causal function need not be a simple one and could involve both a variety of lags and non-linear terms.

It can be concluded that

- (i) the causes of the seasonal components can be expected to have differing properties, and,
- (ii) the seasonal components cannot be assumed to be deterministic.

Even though some of the basic causes can be thought of as deterministic series, such as the calendar and timing decisions, there is certainly no reason to suppose that they will lead to deterministic seasonal components, as the reaction to these causes need not be deterministic. The other basic causes, weather and expectation, are not deterministic and consequently the resulting seasonal effects are chiefly random.

The type of economic time series that are clearly seasonal and therefore need to be adjusted are generally those concerned with production, sales, inventories, personal income and consumption, government receipts and expenditure, profits, unemployment rates, imports and exports. The types of series that are clearly not seasonal and therefore do not require any form of adjustment include prices (other than farm and food prices), interest rates, exchange rates, index of consumer sentiment, liquid liabilities to foreigners and government assets.

Seasonal adjustment methods

At present several techniques are used by EU Member States to obtain seasonally adjusted or cycle-trend data. Two main groups of methods can be distinguished:

- moving average based methods;
- model based methods.

The former methods are based on different kinds of moving averages, without an underlying explicit model. These methods were developed mainly on an empirical basis. The repeated application of suitable moving averages eliminates the seasonal and/or irregular components giving an estimation of the cycle-trend component. The most widely used method for seasonal adjustment is the Census X-11 (or any of its upgrades), which is a moving average based method.

Model based seasonal adjustment methods estimate the trend, seasonal, irregular and cyclical components with signal extraction techniques applied to the underlying ARIMA model. Each component is represented by an equivalent ARIMA expression that is estimated by maximising the variance of the irregular component and, consequently, by minimising the variance of the other components. TRAMO/SEATS is a well known method that belongs to this group. The various components of GDP in this news release have been seasonally adjusted using this more reliable approach ■

The scope of this news release is to continue familiarising users with the concept of seasonal adjustments as applied to the GDP expenditure approach components at current and constant prices. The figures should be interpreted with caution, since the seasonally-adjusted GDP level varies depending on the number of observations and the detail in the GDP components. This release is technical in nature and is therefore primarily intended for econometricians and statisticians. It contains information on the models used and on the resulting diagnostics. The figures in this release are based on the official GDP figures published on the 9th December in news release number 267/2005.

Table 1. Original data at current prices

							Lm'000	
Period	Consumption	Government Expenditure	Gross Capital Formation	Exports	Imports	GDP	% change (Q _t /Q _{t-1})	
2000	Q1	252,552	81,552	87,931	335,428	379,734	377,729	
	Q2	262,828	80,664	123,064	396,469	446,044	416,981	10.39
	Q3	274,143	79,104	93,563	431,898	439,456	439,252	5.34
	Q4	282,641	82,959	120,984	409,028	474,865	420,747	-4.21
2001	Q1	248,025	84,106	99,444	340,784	381,958	390,401	-7.21
	Q2	267,663	89,176	78,217	367,871	372,125	430,802	10.35
	Q3	285,478	85,665	65,694	372,404	358,564	450,677	4.61
	Q4	285,377	97,684	80,919	338,771	374,986	427,765	-5.08
2002	Q1	263,417	92,846	68,129	316,198	331,365	409,225	-4.33
	Q2	272,929	100,442	66,298	388,825	387,858	440,636	7.68
	Q3	286,518	91,662	41,690	412,315	370,002	462,183	4.89
	Q4	272,624	91,532	83,443	375,260	384,383	438,476	-5.13
2003	Q1	264,752	104,806	94,714	315,943	365,700	414,515	-5.46
	Q2	275,461	102,084	95,685	368,656	389,902	451,984	9.04
	Q3	295,465	93,481	69,404	401,575	388,242	471,683	4.36
	Q4	289,234	95,948	90,488	361,602	378,719	458,553	-2.78
2004	Q1	264,795	104,797	74,104	327,480	338,746	432,430	-5.70
	Q2	284,468	103,139	102,190	354,099	391,016	452,880	4.73
	Q3	305,508	99,384	81,618	367,538	375,787	478,261	5.60
	Q4	302,552	104,706	138,038	337,188	418,901	463,583	-3.07
2005	Q1	267,713	97,453	124,113	286,215	340,637	434,857	-6.20
	Q2	296,631	105,018	117,799	341,940	384,292	477,096	9.71
	Q3	317,318	101,333	88,414	382,772	388,356	501,481	5.11

Table 2. Final seasonally adjusted series at current prices

							Lm'000	
Period	Consumption	Government Expenditure	Gross Capital Formation	Exports	Imports	GDP	% change (Q _t /Q _{t-1})	
2000	Q1	269,672	80,710	88,013	380,641	413,364	405,671	
	Q2	267,257	78,984	115,791	388,648	436,405	414,276	2.12
	Q3	265,669	82,231	117,547	395,450	438,117	422,781	2.05
	Q4	269,771	82,489	106,171	406,392	449,593	415,230	-1.79
2001	Q1	265,514	83,310	98,766	386,717	415,782	418,525	0.79
	Q2	271,847	87,058	74,070	360,613	364,083	429,505	2.62
	Q3	275,330	89,212	83,392	340,977	357,472	431,439	0.45
	Q4	274,548	97,282	70,747	336,591	355,035	424,133	-1.69
2002	Q1	280,130	91,829	66,987	358,819	360,707	437,058	3.05
	Q2	277,316	97,735	62,721	381,153	379,472	439,453	0.55
	Q3	275,953	95,495	53,553	377,516	368,873	433,644	-1.32
	Q4	263,557	91,799	72,945	372,845	363,936	437,211	0.82
2003	Q1	282,001	103,182	92,923	358,531	398,084	438,553	0.31
	Q2	279,419	99,314	89,960	361,385	381,470	448,608	2.29
	Q3	282,365	97,282	89,173	367,681	387,055	449,447	0.19
	Q4	280,523	96,240	78,993	359,273	358,573	456,457	1.56
2004	Q1	284,841	103,455	73,190	371,623	368,747	464,361	1.73
	Q2	287,226	100,485	96,317	347,117	382,560	448,585	-3.40
	Q3	290,445	103,106	104,743	336,515	374,636	460,174	2.58
	Q4	292,545	104,512	119,789	335,016	396,613	455,249	-1.07
2005	Q1	290,964	96,840	122,387	324,797	370,809	464,179	1.96
	Q2	298,485	102,379	111,383	335,199	375,983	471,462	1.57
	Q3	301,346	104,996	113,771	350,461	387,166	483,409	2.53

Table 3. Information on models at current prices

Variable	Status of adjustment	Time span (n° of obs.)	Arima model	Transformation	Mean correction	Outliers	ARIMA decomposition	Seasonality
Consumption	Accepted	Q1.2000 - Q3.2005 (23)	(0 1 1)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC; 1: AO Q4.2002,	Exact	Seasonal model used
Government Expenditure	Accepted	Q1.2000 - Q3.2005 (23)	(0 1 1)(0 1 1)	Logarithm	Yes	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Gross Capital Formation	Accepted	Q1.2000 - Q3.2005 (23)	(0 1 0)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Exports	Accepted	Q1.2000 - Q3.2005 (23)	(0 1 1)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Imports	Accepted	Q1.2000 - Q3.2005 (23)	(0 1 1)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used

Table 4. Information on diagnostics at current prices

Variable	Ljung-Box on residuals	Ljung-Box on squared residuals	Box-Pierce on residuals	Box-Pierce on squared residuals	Normality	Skewness	Kurtosis	Percentage of outliers
Consumption	3.85 [0, 18.30] 5%	10.61 [0, 18.30] 5%	1.35 [0, 5.99] 5%	2.47 [0, 5.99] 5%	0.90 [0, 5.99] 5%	-0.21 [-1.16, 1.16] 5%	1.95 [0.67, 5.33] 5%	4.35% [0%, 5.0%] ad-hoc
Government Expenditure	12.25 [0, 18.30] 5%	10.88 [0, 18.30] 5%	6.06 [0, 5.99] 5%	0.93 [0, 5.99] 5%	0.35 [0, 5.99] 5%	-0.32 [-1.16, 1.16] 5%	2.72 [0.67, 5.33] 5%	0.00% [0%, 5.0%] ad-hoc
Gross Capital Formation	9.58 [0, 19.70] 5%	18.04 [0, 19.70] 5%	1.49 [0, 5.99] 5%	1.75 [0, 5.99] 5%	0.12 [0, 5.99] 5%	-0.05 [-1.13, 1.13] 5%	3.39 [0.74, 5.26] 5%	0.00% [0%, 5.0%] ad-hoc
Exports	11.82 [0, 18.30] 5%	14.61 [0, 18.30] 5%	4.17 [0, 5.99] 5%	0.53 [0, 5.99] 5%	0.30 [0, 5.99] 5%	0.01 [-1.13, 1.13] 5%	2.36 [0.74, 5.26] 5%	0.00% [0%, 5.0%] ad-hoc
Imports	10.77 [0, 18.30] 5%	11.88 [0, 18.30] 5%	0.51 [0, 5.99] 5%	0.89 [0, 5.99] 5%	0.52 [0, 5.99] 5%	-0.41 [-1.13, 1.13] 5%	2.90 [0.74, 5.26] 5%	0.00% [0%, 5.0%] ad-hoc

Figure 1. Consumption at current prices

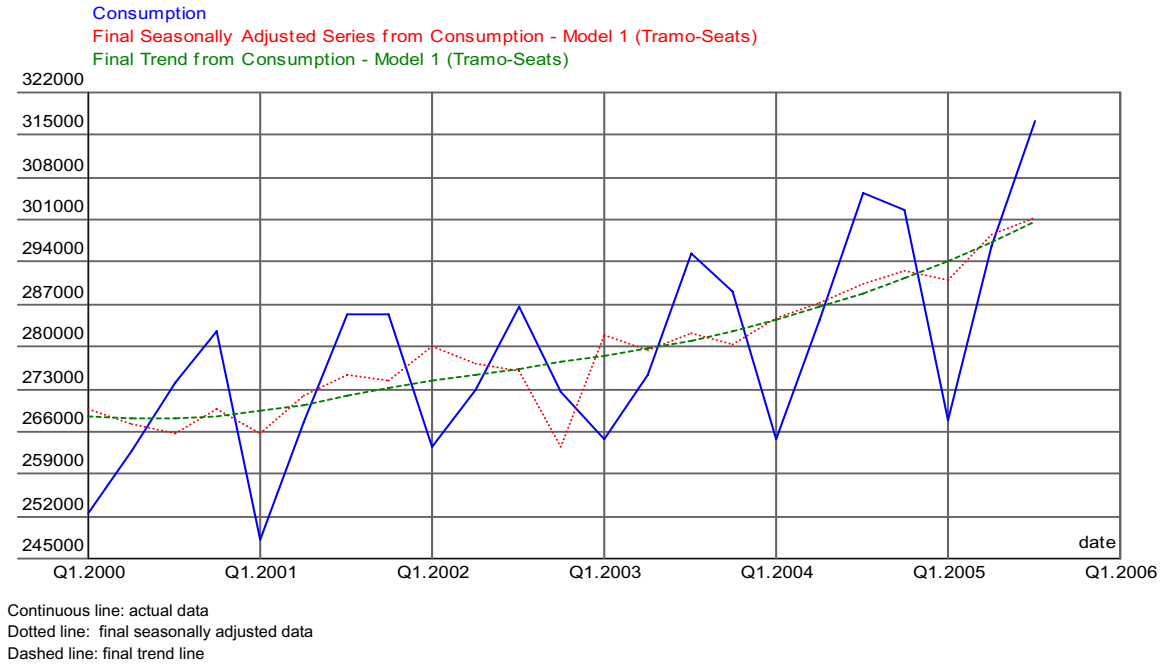


Figure 2. Government consumption expenditure at current prices

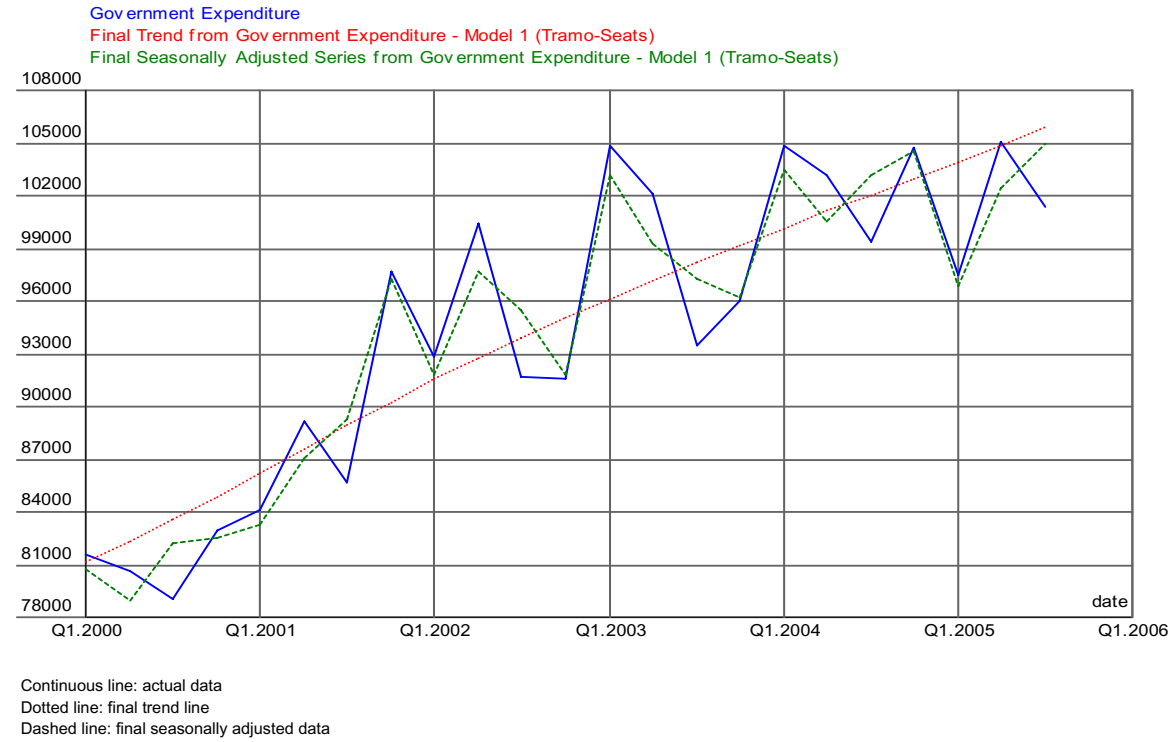
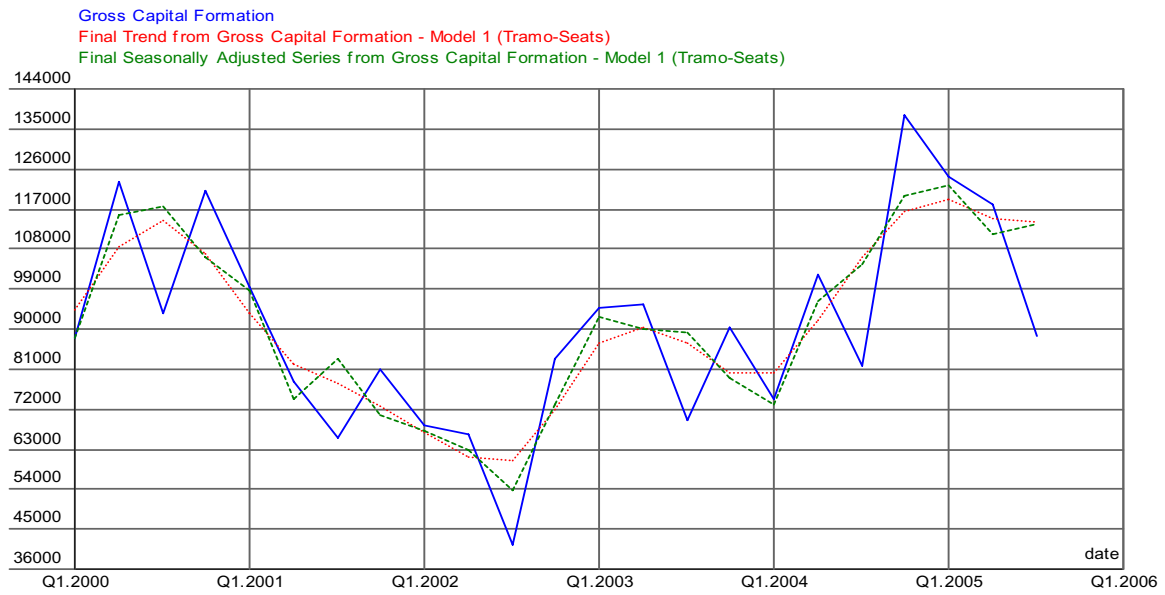
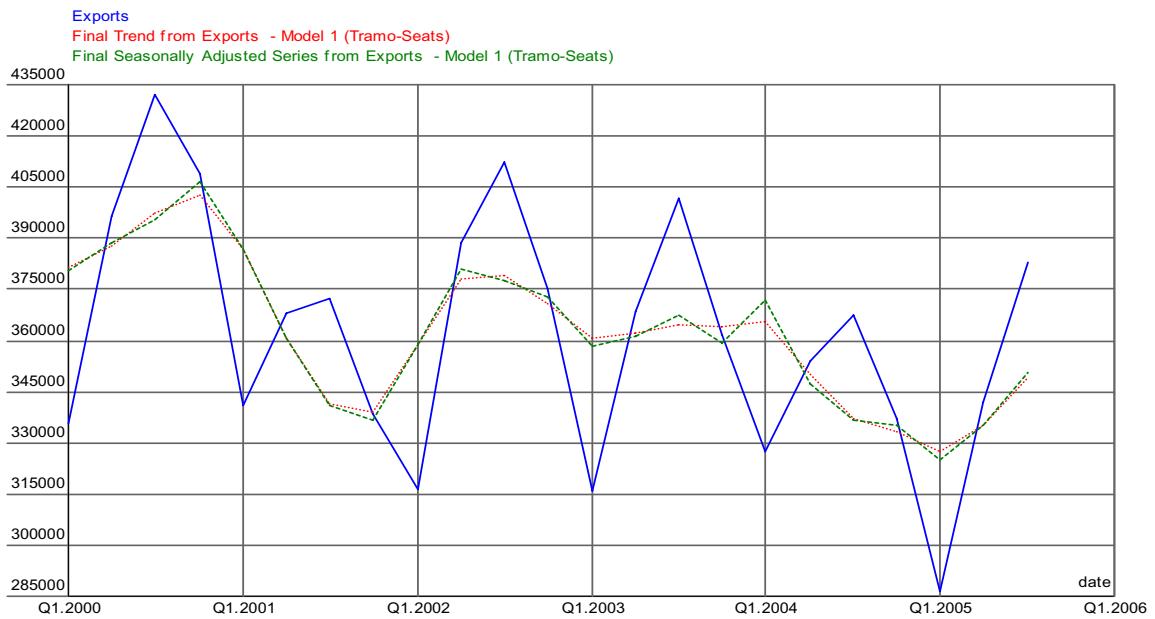


Figure 3. Gross Capital Formation at current prices



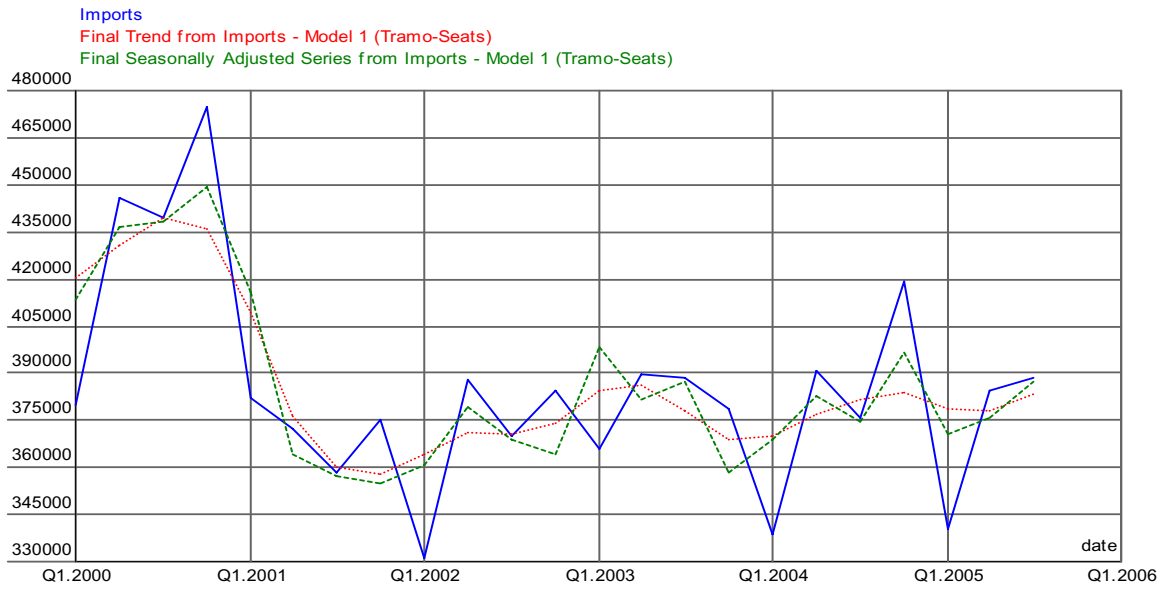
Continuous line: actual data
 Dotted line: final trend line
 Dashed line: final seasonally adjusted data

Figure 4. Exports of Goods and Services at current prices



Continuous line: actual data
 Dotted line: final trend line
 Dashed line: final seasonally adjusted data

Figure 5. Imports of Goods and Services at current prices



Continuous line: actual data
Dotted line: final trend line
Dashed line: final seasonally adjusted data

Table 5. Original data at constant prices

		Lm'000						
Period	Consumption	Government Expenditure	Gross Capital Formation	Exports	Imports	GDP	% change (Q _t /Q _{t-1})	
2000	Q1	252,552	81,552	87,931	335,428	379,734	377,729	
	Q2	262,828	80,664	123,064	396,469	446,044	416,981	10.39
	Q3	274,143	79,104	93,563	431,898	439,456	439,252	5.34
	Q4	282,641	82,959	120,984	409,028	474,865	420,747	-4.21
2001	Q1	248,213	77,488	96,337	379,982	403,650	398,370	-5.32
	Q2	262,281	81,556	75,455	402,932	396,578	425,646	6.85
	Q3	278,340	77,925	63,372	398,563	387,096	431,104	1.28
	Q4	280,201	89,700	78,130	368,995	403,039	413,987	-3.97
2002	Q1	259,303	84,070	62,439	340,480	347,348	398,944	-3.63
	Q2	265,466	91,065	63,480	415,726	411,183	424,554	6.42
	Q3	274,870	82,320	39,011	436,471	391,378	441,294	3.94
	Q4	261,436	82,360	76,980	400,542	403,096	418,222	-5.23
2003	Q1	257,719	93,505	87,616	348,300	400,416	386,724	-7.53
	Q2	265,049	90,051	88,393	394,887	428,820	409,560	5.90
	Q3	282,725	81,919	64,330	423,667	423,671	428,970	4.74
	Q4	276,068	84,227	83,786	393,062	408,810	428,333	-0.15
2004	Q1	252,254	89,322	67,978	365,669	380,216	395,007	-7.78
	Q2	263,152	88,415	93,413	394,565	429,445	410,100	3.82
	Q3	282,280	84,806	74,933	404,849	419,669	427,199	4.17
	Q4	278,881	89,686	125,922	392,992	465,286	422,195	-1.17
2005	Q1	245,966	83,364	112,293	323,591	369,376	395,838	-6.24
	Q2	267,847	87,819	106,234	376,968	421,031	417,837	5.56
	Q3	290,685	84,733	79,461	409,279	424,658	439,500	5.18

Table 6. Final seasonally adjusted series at constant prices

		Lm'000						
Period	Consumption	Government Expenditure	Gross Capital Formation	Exports	Imports	GDP	% change (Q _t /Q _{t-1})	
2000	Q1	269,874	81,289	87,490	373,079	415,957	395,775	
	Q2	268,238	79,054	115,835	387,631	430,425	420,333	6.20
	Q3	266,582	82,387	119,087	402,442	435,483	435,016	3.49
	Q4	268,058	81,632	105,490	407,279	455,869	406,591	-6.53
2001	Q1	264,698	77,238	95,852	422,554	442,151	418,190	2.85
	Q2	267,546	79,927	71,024	393,899	382,691	429,705	2.75
	Q3	270,000	81,160	80,663	371,406	383,596	419,633	-2.34
	Q4	268,984	88,267	68,123	367,399	386,920	405,852	-3.28
2002	Q1	272,798	83,798	62,122	378,888	380,475	417,130	2.78
	Q2	270,420	89,245	59,752	406,480	396,786	429,112	2.87
	Q3	267,117	85,738	49,658	406,483	387,837	421,159	-1.85
	Q4	252,775	81,046	67,120	398,415	386,979	412,377	-2.09
2003	Q1	271,518	93,200	87,170	387,835	438,599	401,123	-2.73
	Q2	269,947	88,252	83,200	386,479	413,810	414,068	3.23
	Q3	270,901	85,320	81,887	394,539	419,834	412,813	-0.30
	Q4	267,799	82,884	73,054	390,501	392,463	421,775	2.17
2004	Q1	269,227	89,031	67,633	407,303	416,477	416,717	-1.20
	Q2	267,662	86,649	87,926	386,430	414,418	414,250	-0.59
	Q3	267,991	88,327	95,384	376,981	415,866	412,817	-0.35
	Q4	269,066	88,255	109,791	390,053	446,672	410,491	-0.56
2005	Q1	266,964	83,093	111,722	360,672	404,608	417,842	1.79
	Q2	271,616	86,065	99,996	369,359	406,302	420,734	0.69
	Q3	274,174	88,251	101,149	381,023	420,806	423,790	0.73

Table 7. Information on models at constant prices

Variable	Status of adjustment	Time span (n° of obs.)	Arima model	Transformation	Mean correction	Outliers	ARIMA decomposition	Seasonality
Consumption	Accepted	Q1.2000 - Q3.2005 (23)	(0 1 1)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC; 1: AO Q4.2002,	Exact	Seasonal model used
Government Expenditure	Accepted	Q1.2000 - Q3.2005 (23)	(0 1 1)(0 1 1)	Logarithm	Yes	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Gross Capital Formation	Accepted	Q1.2000 - Q3.2005 (23)	(0 1 1)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Exports	Accepted	Q1.2000 - Q3.2005 (23)	(0 1 0)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Imports	Accepted	Q1.2000 - Q3.2005 (23)	(0 1 1)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC; 1: TC Q2.2001,	Exact	Seasonal model used

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Table 8. Information on diagnostics at constant prices

Variable	Ljung-Box on residuals	Ljung-Box on squared residuals	Box-Pierce on residuals	Box-Pierce on squared residuals	Normality	Skewness	Kurtosis	Percentage of outliers
Consumption	7.40 [0, 18.30] 5%	15.67 [0, 18.30] 5%	0.07 [0, 5.99] 5%	0.86 [0, 5.99] 5%	0.59 [0, 5.99] 5%	0.19 [-1.16, 1.16] 5%	2.17 [0.67, 5.33] 5%	4.35% [0%, 5.0%] ad-hoc
Government Expenditure	8.32 [0, 18.30] 5%	8.91 [0, 18.30] 5%	4.84 [0, 5.99] 5%	1.38 [0, 5.99] 5%	0.24 [0, 5.99] 5%	0.12 [-1.16, 1.16] 5%	2.47 [0.67, 5.33] 5%	0.00% [0%, 5.0%] ad-hoc
Gross Capital Formation	11.35 [0, 18.30] 5%	18.53 [0, 18.30] 5%	2.37 [0, 5.99] 5%	1.81 [0, 5.99] 5%	0.16 [0, 5.99] 5%	-0.02 [-1.13, 1.13] 5%	3.46 [0.74, 5.26] 5%	0.00% [0%, 5.0%] ad-hoc
Exports	9.77 [0, 19.70] 5%	13.03 [0, 19.70] 5%	2.80 [0, 5.99] 5%	0.33 [0, 5.99] 5%	0.55 [0, 5.99] 5%	-0.18 [-1.13, 1.13] 5%	2.23 [0.74, 5.26] 5%	0.00% [0%, 5.0%] ad-hoc
Imports	4.96 [0, 18.30] 5%	9.70 [0, 18.30] 5%	1.16 [0, 5.99] 5%	0.35 [0, 5.99] 5%	3.22 [0, 5.99] 5%	1.02 [-1.16, 1.16] 5%	3.62 [0.67, 5.33] 5%	4.35% [0%, 5.0%] ad-hoc

Figure 6. Consumption at constant prices

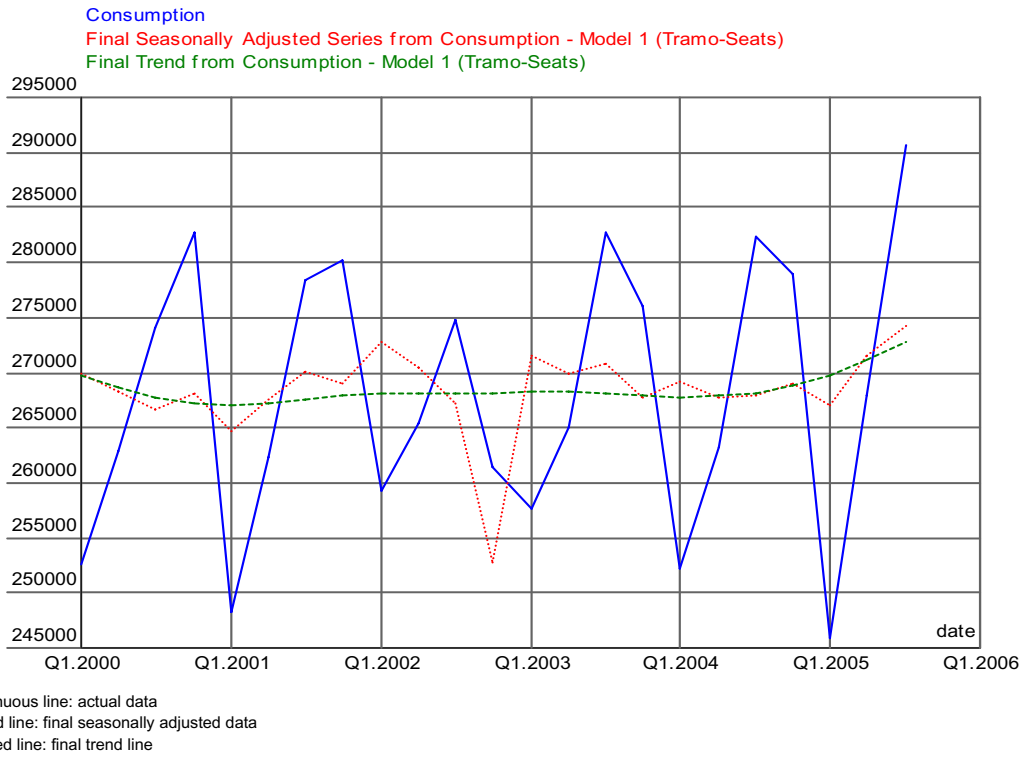


Figure 7. Government consumption expenditure at constant prices

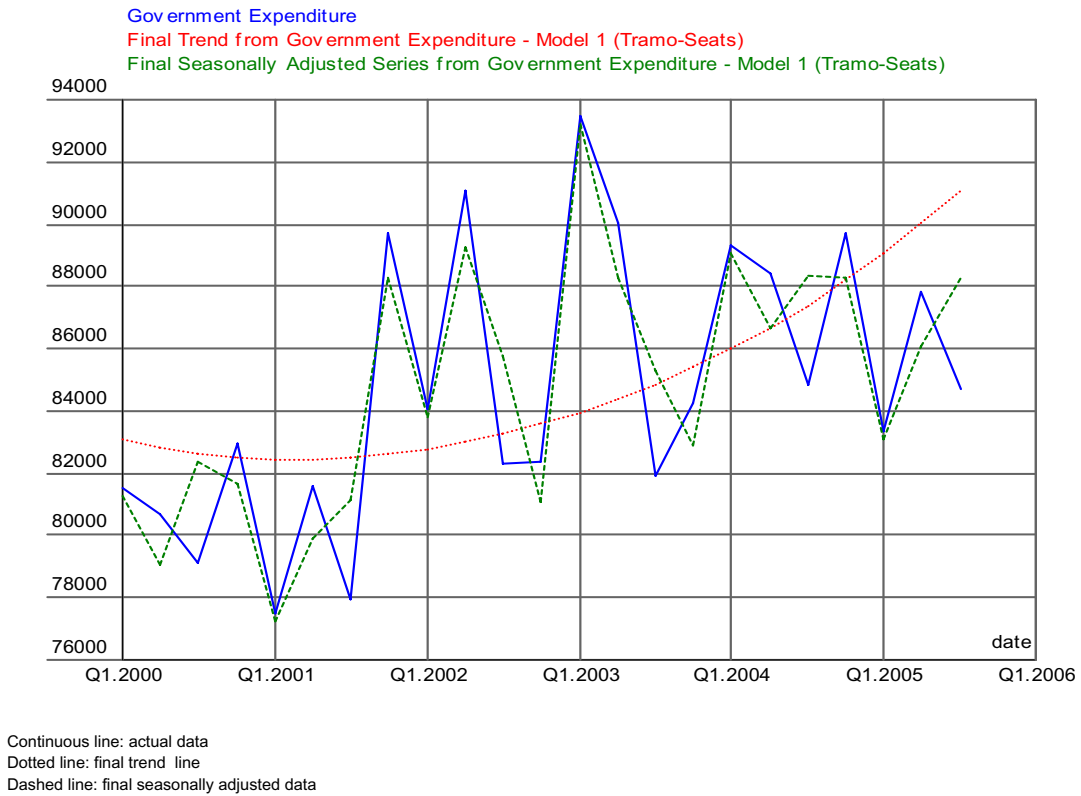


Figure 8. Gross Capital Formation at constant prices

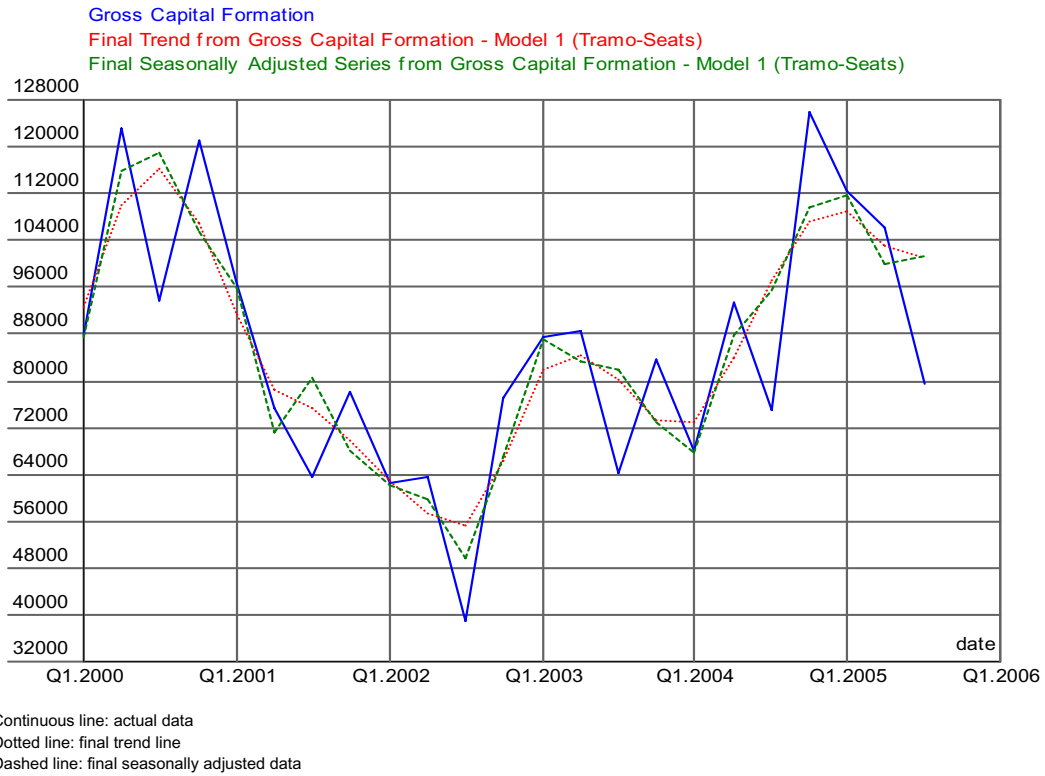
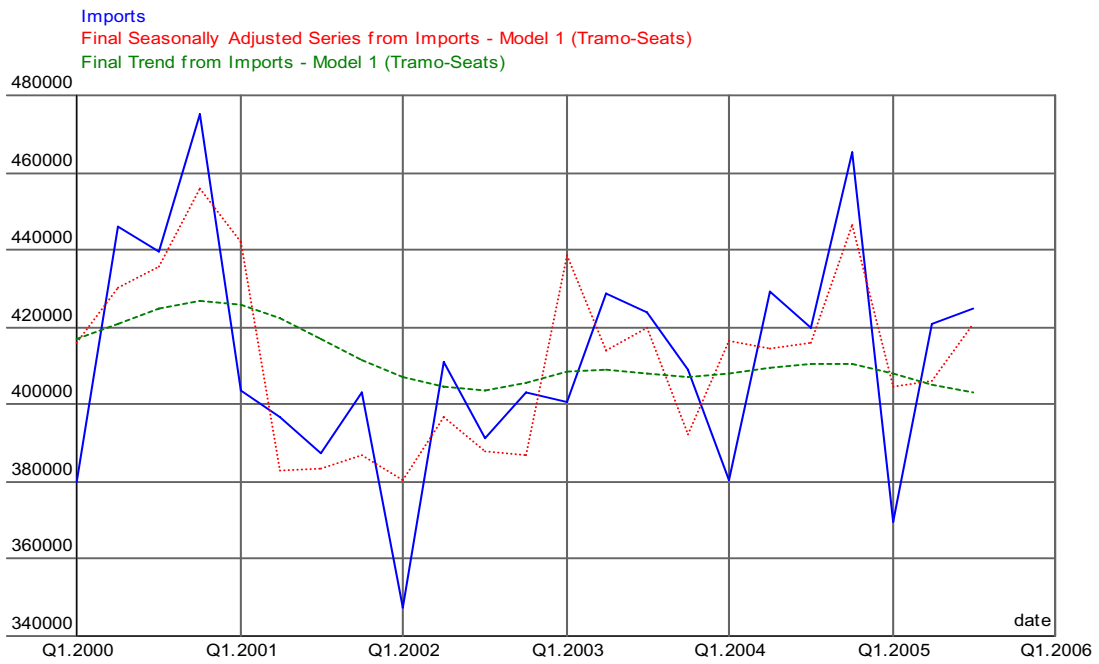


Figure 9. Exports of Goods and Services at constant prices



Figure 10. Imports of Goods and Services at constant prices



Continuous line: actual data
Dotted line: final seasonally adjusted data
Dashed line: final trend line