

News Release



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National Accounts

Seasonally adjusted GDP 2000 Q1-2005 Q4

Seasonality can be defined as a pattern of a time series, which is repeated at regular intervals every year. Seasonal fluctuations in data make it difficult to analyse whether changes in data for a given period reflect important increases or decreases in the level of the data, or else are due to regularly occurring variation. In pursuit of economic measures that are independent of seasonal variations, a variety of methods have been developed to remove the effect of seasonal changes from the original data to produce seasonally adjusted data. The results from the seasonal adjustment process provide more readily interpretable measures of changes occurring in a given period, and reflect real economic movements without the misleading seasonal changes.

Not all statistical series are significantly affected by seasonal or calendar influences which are regular enough to be described as 'stable', and so no seasonal or calendar influences can usefully be removed from them. In such cases the original series may be regarded as being the seasonally adjusted series. One example is the consumption of fixed capital series.

It is possible to seasonally adjust an aggregate series either directly or by seasonally adjusting a number of its components and adding the results. The latter (aggregative) approach is widely employed for most of the principal aggregates in the national accounts (and balance of payments). In the case of the Maltese scenario, this method has been adopted for the seasonal adjustment of the primary macroeconomic variable, that is, the Gross Domestic Product (GDP). Besides retaining, as far as possible, the essential accounting relationships, the aggregative approach is needed because many aggregates typically include components characterised by different seasonal and trend characteristics, and thus requiring different methods of adjustment.

The Main Principles of Seasonal Adjustment

For the purpose of seasonal adjustment, a time series is generally considered to be made up of three main components:

1. the trend-cycle component;
2. the seasonal component; and
3. the irregular component

Each of these is in turn made up of several sub-components, as follows:

- (a) *The trend-cycle component* is the underlying path or general direction reflected in the data, which is in turn constituted from a combination of the long-term trend and the business cycle movements in the data.

Theme:
Economy and Finance

Compiled by:

National Accounts Unit
e-mail: nationalaccounts.nso@gov.mt
Tel: 25997259

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National Statistics Office
Library & Information Unit
Lascaris, Valletta CMR 02, Malta
Tel: (+356) 25997219
Fax: (+356) 25997205
e-mail: nso@gov.mt
<http://www.nso.gov.mt>

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(b) *The seasonal component* includes

- (i) a seasonal effect which is narrowly defined, representing an effect that is reasonably stable in terms of annual timing, direction and magnitude. Possible causes for this effect are natural factors, administrative or legal measures, social/cultural traditions, and calendar-related effects that are stable in annual timing (e.g. public holidays such as Christmas).
- (ii) Calendar-related systematic effects on the time series that are not stable in annual timing due to variation in the calendar from year to year. They include the following:
 - The trading-day effect which is the effect of variations from year to year in the number of working, or trading, days and the weekday composition for a particular month or quarter relative to the standard for that particular month or quarter;
 - The effects of events that occur at regular intervals but not exactly at the same time each year, such as moving holidays, or paydays for large groups of employees, pension payments, and so on;
 - Other calendar effects such as leap-year and length-of-quarter effects.

Both the seasonal effects narrowly defined and the other calendar-related effects represent systematic, persistent, predictable, and identifiable effects.

(c) *The irregular component* captures effects that are unpredictable unless additional information is available, in terms of timing, impact, and duration. The irregular component includes the following:

- (i) Irregular effects narrowly defined, which is defined to behave as a stochastic variable that is symmetrically distributed around its expected value (0 for an additive model and 1 for a multiplicative model);
- (ii) Outlier effects;
- (iii) Other irregular effects, such as the effects of unseasonable weather, natural disasters, strikes, and irregular sales campaigns.

While seasonal adjustment represents an analytical reformulation of the original data, the purpose of this analysis is to complement the original data – it can never replace the original data for the following reasons:

- unadjusted data are useful in their own right; the non-seasonally adjusted data show the actual economic events that have occurred, while the seasonally adjusted data represent an analytical elaboration of the data designed to show the underlying trends and short-run movements in the series which may be hidden by the seasonal variations. Compilation of seasonally adjusted data, exclusively, represents a loss of information.
- No unique solution exists on how to conduct seasonal adjustment.
- Seasonally adjusted data are subject to revisions as future data becomes available, even when the original data are not revised.
- When compiling Quarterly National Accounts, balancing and reconciling the accounts are better done on the original unadjusted quarterly estimates.
- While errors in the source data may be more easily detected from seasonally adjusted data, it may be easier to identify the source of the errors and correct them when working with the unadjusted data.

Note

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 10th March 2006 in news release number 47/2006.

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	258,484	81,955	90,545	335,428	379,734	386,678	
	Q2	267,869	81,092	127,642	396,469	446,044	427,028	10.44
	Q3	287,357	79,588	92,080	431,898	439,456	451,467	5.72
	Q4	293,036	83,453	120,471	409,028	474,865	431,123	-4.51
2001	Q1	256,396	84,473	99,720	341,564	381,958	400,195	-7.17
	Q2	275,198	89,572	80,375	362,934	372,125	435,954	8.94
	Q3	301,896	86,367	63,703	371,799	358,564	465,201	6.71
	Q4	302,281	98,219	77,995	332,835	374,986	436,344	-6.20
2002	Q1	274,085	93,308	66,433	316,198	331,365	418,659	-4.05
	Q2	285,169	100,876	65,389	388,825	387,858	452,401	8.06
	Q3	299,689	91,905	41,845	412,315	370,002	475,752	5.16
	Q4	289,546	92,014	77,574	375,260	384,383	450,011	-5.41
2003	Q1	273,980	105,201	93,890	315,943	365,700	423,314	-5.93
	Q2	288,706	102,569	88,999	368,656	389,902	459,028	8.44
	Q3	314,409	94,004	60,289	401,575	388,242	482,035	5.01
	Q4	309,103	96,480	76,226	361,602	378,719	464,692	-3.60
2004	Q1	273,938	106,537	61,171	328,099	339,265	430,480	-7.36
	Q2	297,499	104,280	87,545	354,910	390,352	453,882	5.44
	Q3	325,707	101,232	60,519	371,578	378,452	480,584	5.88
	Q4	315,185	106,172	123,228	338,841	417,966	465,460	-3.15
2005	Q1	278,145	100,415	108,359	288,922	342,449	433,392	-6.89
	Q2	318,725	107,923	98,913	342,952	385,512	483,001	11.45
	Q3	339,751	105,134	86,078	381,901	395,956	516,908	7.02
	Q4	328,934	104,328	152,088	358,750	450,307	493,793	-4.47

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	278,192	80,852	88,761	379,352	412,249	414,908	
	Q2	274,606	79,048	119,819	389,102	437,699	424,875	2.40
	Q3	274,137	82,442	120,463	395,264	439,688	432,618	1.82
	Q4	280,109	83,856	104,903	407,331	447,845	428,354	-0.99
2001	Q1	276,102	83,354	97,598	386,290	414,660	428,684	0.08
	Q2	281,322	87,271	75,576	356,189	365,163	435,195	1.52
	Q3	287,406	89,481	83,520	340,263	358,755	441,915	1.54
	Q4	291,031	98,740	67,826	331,457	353,654	435,401	-1.47
2002	Q1	294,222	92,048	64,870	357,604	359,734	449,010	3.13
	Q2	290,008	98,226	61,524	381,597	380,599	450,756	0.39
	Q3	284,750	95,209	55,025	377,338	370,197	442,124	-1.91
	Q4	281,294	92,635	67,369	373,706	362,519	452,485	2.34
2003	Q1	294,955	103,703	91,599	357,318	397,010	450,565	-0.42
	Q2	292,343	99,859	83,719	361,806	382,604	455,124	1.01
	Q3	296,932	97,330	79,383	367,508	388,445	452,707	-0.53
	Q4	300,366	97,188	66,042	360,102	357,174	466,523	3.05
2004	Q1	297,881	105,060	59,741	371,065	368,315	465,432	-0.23
	Q2	299,741	101,539	82,505	348,318	383,048	449,054	-3.52
	Q3	306,193	104,712	79,758	340,055	378,650	452,068	0.67
	Q4	306,917	106,935	106,390	337,434	394,181	463,496	2.53
2005	Q1	304,693	99,126	105,773	326,759	371,774	464,577	0.23
	Q2	318,970	105,083	93,420	336,584	378,303	475,753	2.41
	Q3	319,030	108,669	113,563	349,502	396,166	494,598	3.96
	Q4	321,182	105,101	131,109	357,259	424,676	489,974	-0.93

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 - Q4.2005 (24)	(0 1 1)(0 1 1)	Logarithm	Yes	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Government Expenditure	Accepted	Q1.2000 - Q4.2005 (24)	(0 1 1)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Gross Capital Formation	Accepted	Q1.2000 - Q4.2005 (24)	(0 1 0)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Exports	Accepted	Q1.2000 - Q4.2005 (24)	(0 1 1)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Imports	Accepted	Q1.2000 - Q4.2005 (24)	(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	6.25 [0, 18.30] 5%	8.69 [0, 18.30] 5%	0.07 [0, 5.99] 5%	0.74 [0, 5.99] 5%	2.26 [0, 5.99] 5%	-0.84 [-1.13, 1.13] 5%	3.45 [0.74, 5.26] 5%	0.00% [0%, 5.0%] ad-hoc
Government Expenditure	13.46 [0, 18.30] 5%	10.31 [0, 18.30] 5%	4.65 [0, 5.99] 5%	1.85 [0, 5.99] 5%	0.41 [0, 5.99] 5%	-0.09 [-1.10, 1.10] 5%	2.30 [0.80, 5.20] 5%	0.00% [0%, 5.0%] ad-hoc
Gross Capital Formation	11.48 [0, 19.70] 5%	12.96 [0, 19.70] 5%	1.50 [0, 5.99] 5%	2.21 [0, 5.99] 5%	0.22 [0, 5.99] 5%	0.08 [-1.10, 1.10] 5%	2.50 [0.80, 5.20] 5%	0.00% [0%, 5.0%] ad-hoc
Exports	15.46 [0, 18.30] 5%	14.47 [0, 18.30] 5%	5.01 [0, 5.99] 5%	1.06 [0, 5.99] 5%	0.10 [0, 5.99] 5%	0.11 [-1.10, 1.10] 5%	2.71 [0.80, 5.20] 5%	0.00% [0%, 5.0%] ad-hoc
Imports	8.81 [0, 18.30] 5%	11.62 [0, 18.30] 5%	0.16 [0, 5.99] 5%	0.48 [0, 5.99] 5%	1.05 [0, 5.99] 5%	-0.57 [-1.10, 1.10] 5%	2.88 [0.80, 5.20] 5%	0.00% [0%, 5.0%] ad-hoc

Figure 1. Consumption at current prices

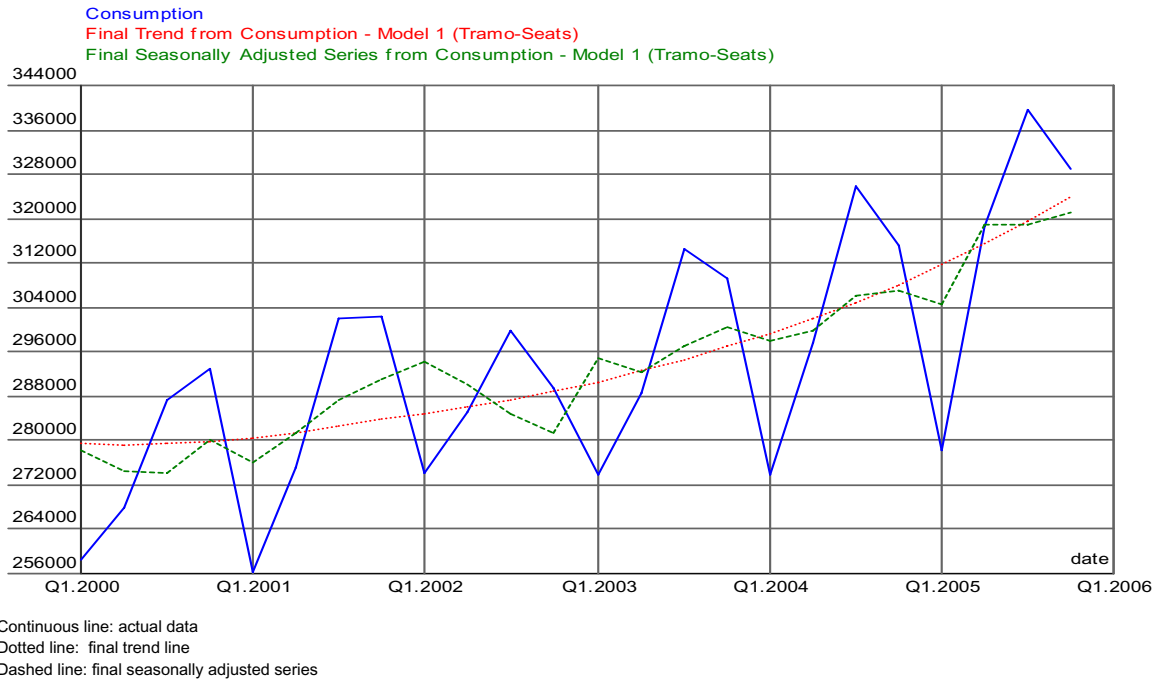


Figure 2. Government consumption expenditure at current prices

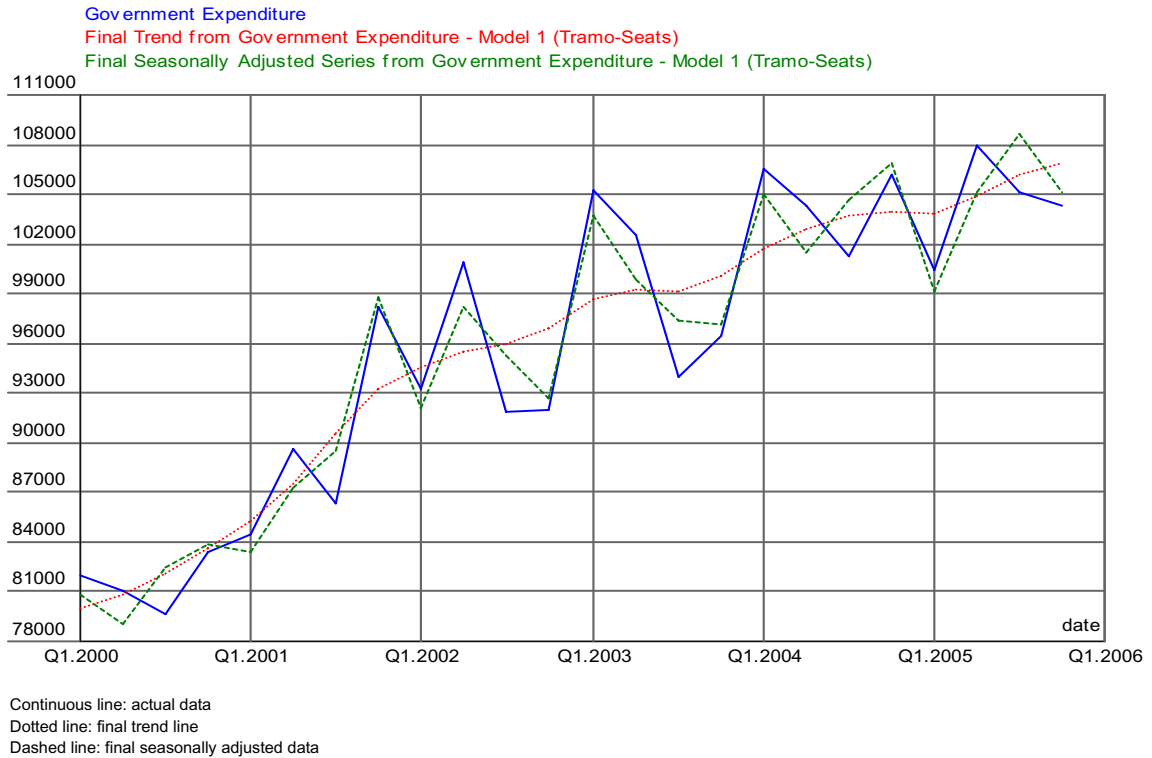
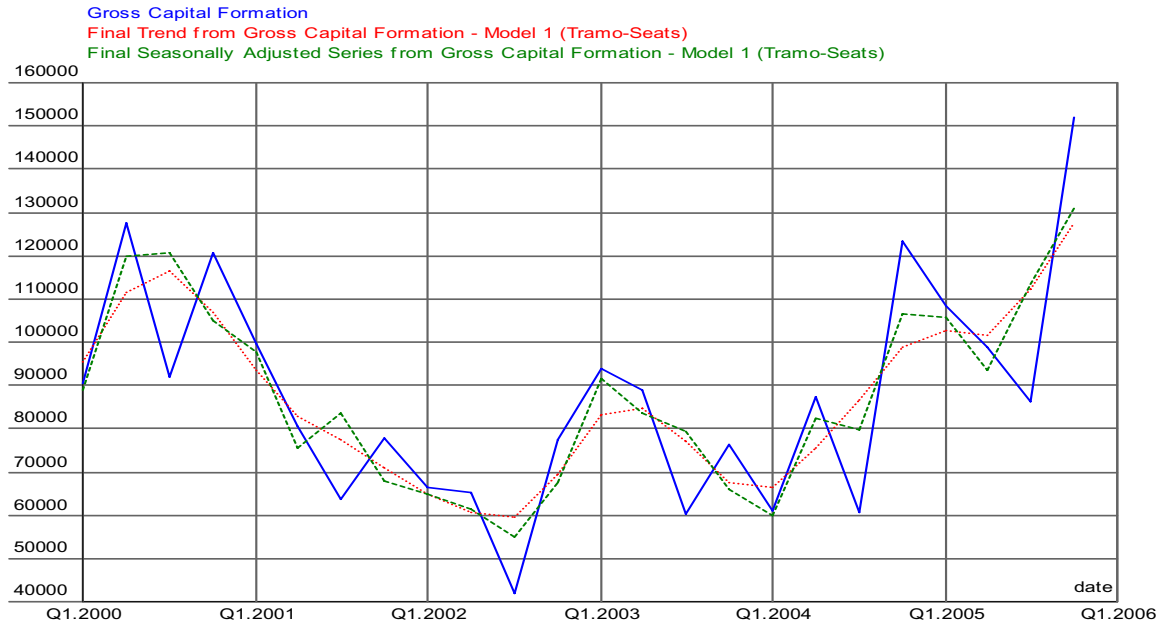
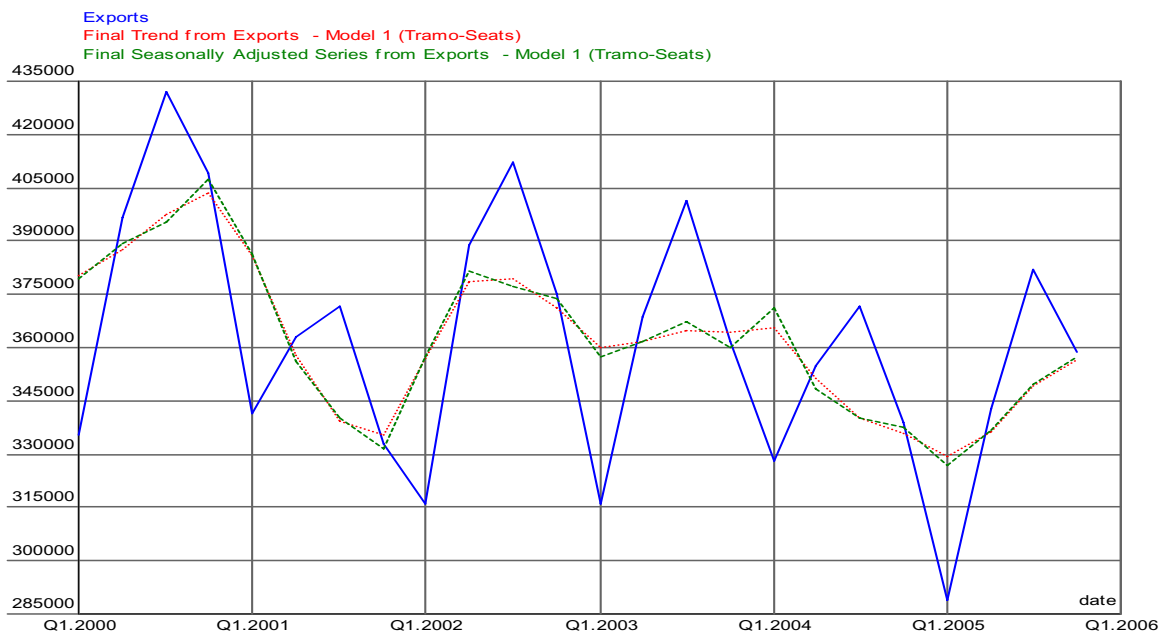


Figure 3. Gross Capital Formation at current prices



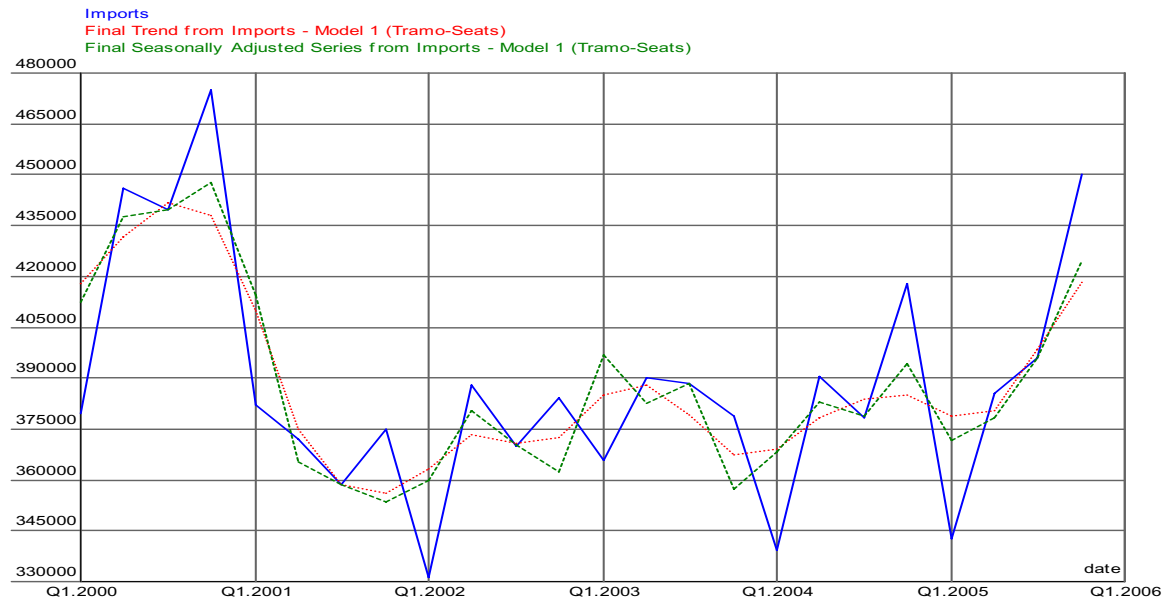
Continuous line: actual data
 Dotted line: final trend line
 Dashed line: final seasonally adjusted data

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	258,484	81,955	90,545	335,428	379,734	386,678	
	Q2	267,869	81,092	127,642	396,469	446,044	427,028	10.44
	Q3	287,357	79,588	92,080	431,898	439,456	451,467	5.72
	Q4	293,036	83,453	120,471	409,028	474,865	431,123	-4.51
2001	Q1	256,472	77,844	96,614	380,889	403,650	408,169	-5.32
	Q2	269,851	81,950	77,558	397,177	396,578	429,958	5.34
	Q3	293,237	78,539	61,444	397,853	387,096	443,977	3.26
	Q4	295,931	90,143	75,299	362,070	403,039	420,404	-5.31
2002	Q1	269,482	85,016	60,697	340,477	347,348	408,324	-2.87
	Q2	276,499	91,382	62,470	415,716	411,183	434,884	6.50
	Q3	288,906	82,413	39,031	436,480	391,378	455,452	4.73
	Q4	277,068	82,775	71,448	400,538	403,096	428,733	-5.87
2003	Q1	266,588	93,951	86,860	348,066	400,416	395,049	-7.86
	Q2	277,868	90,598	82,163	394,889	428,820	416,698	5.48
	Q3	299,760	82,406	55,854	423,660	423,671	438,009	5.11
	Q4	294,824	84,777	70,681	393,061	408,810	434,533	-0.79
2004	Q1	259,365	90,865	56,262	366,388	380,816	392,064	-9.77
	Q2	275,376	89,557	80,146	395,573	428,677	411,975	5.08
	Q3	300,160	86,494	55,827	409,199	421,632	430,048	4.39
	Q4	290,098	91,065	112,532	395,147	463,544	425,298	-1.10
2005	Q1	253,901	85,954	97,868	326,714	371,835	392,602	-7.69
	Q2	287,125	90,402	88,918	378,835	421,846	423,434	7.85
	Q3	307,741	88,035	77,334	408,446	433,901	447,655	5.72
	Q4	291,548	86,961	137,599	390,940	469,945	437,103	-2.36

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	277,188	81,241	89,731	371,916	411,507	408,570	
	Q2	276,456	79,260	119,688	388,146	436,547	427,002	4.51
	Q3	276,104	82,449	119,918	402,285	437,533	443,223	3.80
	Q4	276,964	83,221	104,350	408,071	451,798	420,807	-5.06
2001	Q1	275,434	77,166	95,552	422,226	437,420	432,957	2.89
	Q2	278,291	80,098	72,870	388,776	388,134	431,899	-0.24
	Q3	281,862	81,363	80,239	370,622	385,402	428,684	-0.74
	Q4	282,097	89,893	65,130	361,198	383,466	414,851	-3.23
2002	Q1	285,290	84,274	59,848	377,743	376,407	430,748	3.83
	Q2	283,396	89,315	58,735	406,961	402,425	435,982	1.22
	Q3	279,955	85,376	51,161	406,380	389,663	433,208	-0.64
	Q4	265,621	82,549	61,714	399,057	383,525	425,416	-1.80
2003	Q1	284,355	93,129	85,517	386,474	433,915	415,560	-2.32
	Q2	283,863	88,548	77,237	386,976	419,687	416,938	0.33
	Q3	284,761	85,368	73,334	394,508	421,811	416,160	-0.19
	Q4	283,653	84,547	60,881	390,981	388,959	431,102	3.59
2004	Q1	281,999	90,070	55,445	406,966	412,681	421,800	-2.16
	Q2	279,624	87,531	75,534	387,944	419,550	411,083	-2.54
	Q3	281,217	89,602	73,382	381,104	419,779	405,527	-1.35
	Q4	281,535	90,818	96,506	392,538	441,025	420,371	3.66
2005	Q1	281,291	85,202	96,370	363,133	402,954	423,042	0.64
	Q2	285,977	88,357	84,037	371,717	412,868	417,220	-1.38
	Q3	286,044	91,197	101,792	380,422	431,994	427,462	2.45
	Q4	285,569	86,726	117,778	388,089	447,110	431,052	0.84

Table 7. Information on models at constant prices

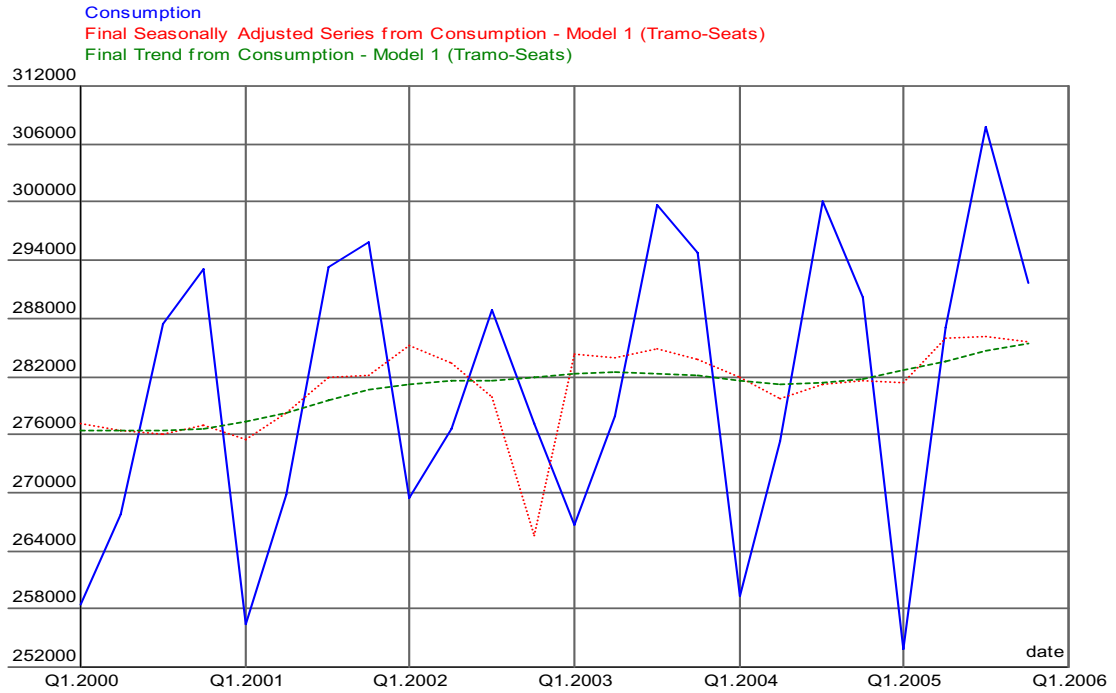
Variable	Status of adjustment	Time span (n° of obs.)	Arima model	Transformation	Mean correction	Outliers	ARIMA decomposition	Seasonality
Consumption	Accepted	Q1.2000 - Q4.2005 (24)	(0 1 1)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC; 1: AO Q4.2002,	Exact	Seasonal model used
Government Expenditure	Accepted	Q1.2000 - Q4.2005 (24)	(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 - Q4.2005 (24)	(0 1 0)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Exports	Accepted	Q1.2000 - Q4.2005 (24)	(0 1 0)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used
Imports	Accepted	Q1.2000 - Q4.2005 (24)	(0 1 1)(0 1 1)	Logarithm	None	Autom.(t-value>2.80):AO,LS,TC	Exact	Seasonal model used

6

Table 8. Information on diagnostics at constant prices

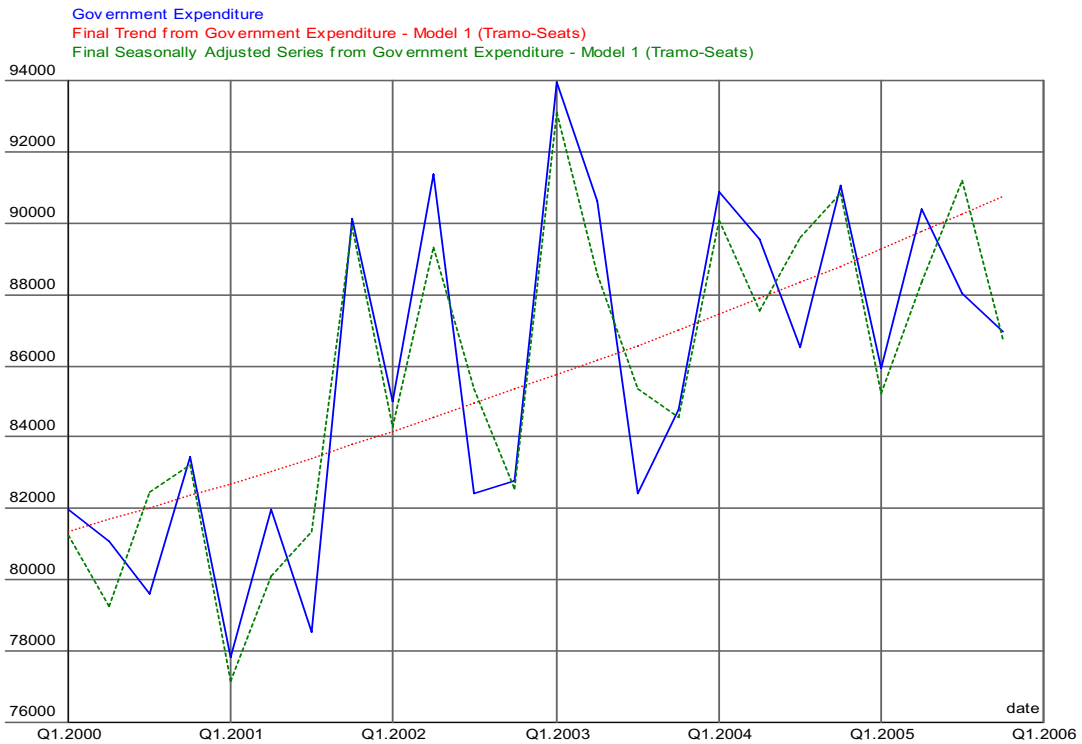
Variable	Ljung-Box on residuals	Ljung-Box on squared residuals	Box-Pierce on residuals	Box-Pierce on squared residuals	Normality	Skewness	Kurtosis	Percentage of outliers
Consumption	12.29 [0, 18.30] 5%	10.93 [0, 18.30] 5%	0.15 [0, 5.99] 5%	0.58 [0, 5.99] 5%	0.82 [0, 5.99] 5%	0.23 [-1.13, 1.13] 5%	2.06 [0.74, 5.26] 5%	4.17% [0%, 5.0%] ad-hoc
Government Expenditure	8.68 [0, 18.30] 5%	7.83 [0, 18.30] 5%	2.67 [0, 5.99] 5%	0.90 [0, 5.99] 5%	0.38 [0, 5.99] 5%	0.10 [-1.13, 1.13] 5%	2.31 [0.74, 5.26] 5%	0.00% [0%, 5.0%] ad-hoc
Gross Capital Formation	12.74 [0, 19.70] 5%	14.74 [0, 19.70] 5%	2.08 [0, 5.99] 5%	2.42 [0, 5.99] 5%	0.19 [0, 5.99] 5%	0.05 [-1.10, 1.10] 5%	2.52 [0.80, 5.20] 5%	0.00% [0%, 5.0%] ad-hoc
Exports	9.53 [0, 19.70] 5%	8.34 [0, 19.70] 5%	2.59 [0, 5.99] 5%	0.79 [0, 5.99] 5%	0.47 [0, 5.99] 5%	-0.31 [-1.10, 1.10] 5%	2.54 [0.80, 5.20] 5%	0.00% [0%, 5.0%] ad-hoc
Imports	8.96 [0, 18.30] 5%	12.31 [0, 18.30] 5%	1.24 [0, 5.99] 5%	0.31 [0, 5.99] 5%	0.14 [0, 5.99] 5%	-0.21 [-1.10, 1.10] 5%	2.94 [0.80, 5.20] 5%	0.00% [0%, 5.0%] ad-hoc

Figure 6. Consumption at constant prices



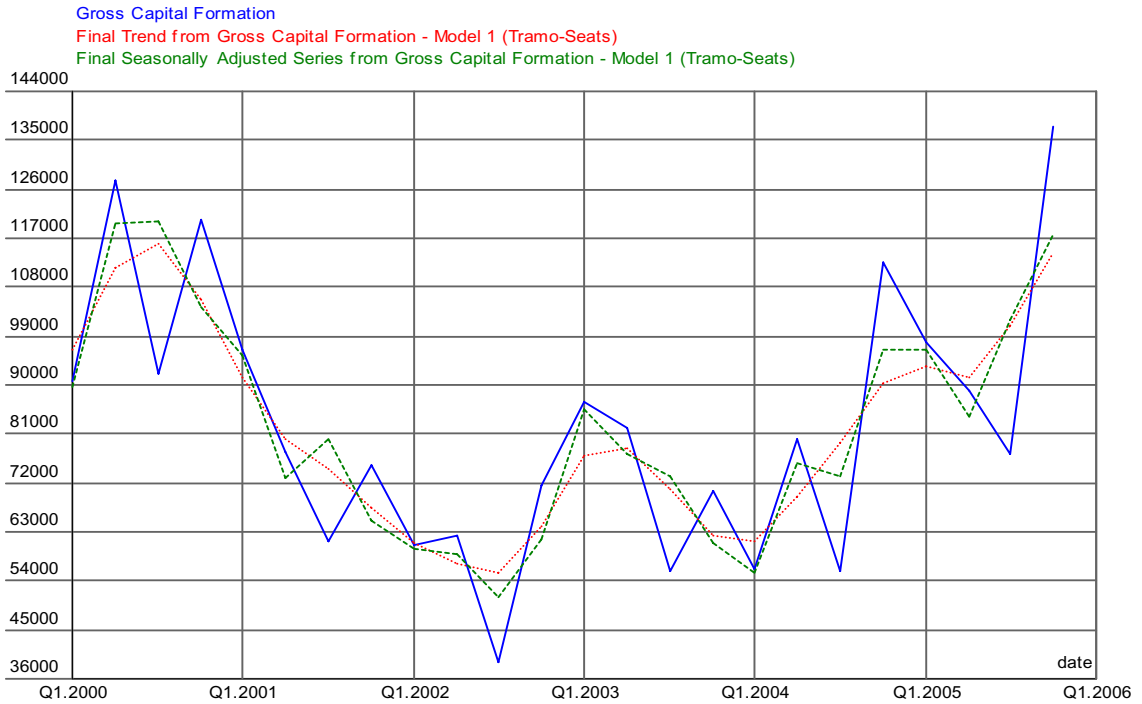
Continuous line: actual data
Dotted line: final seasonally adjusted data
Dashed line: final trend line

Figure 7. Government consumption expenditure at constant prices



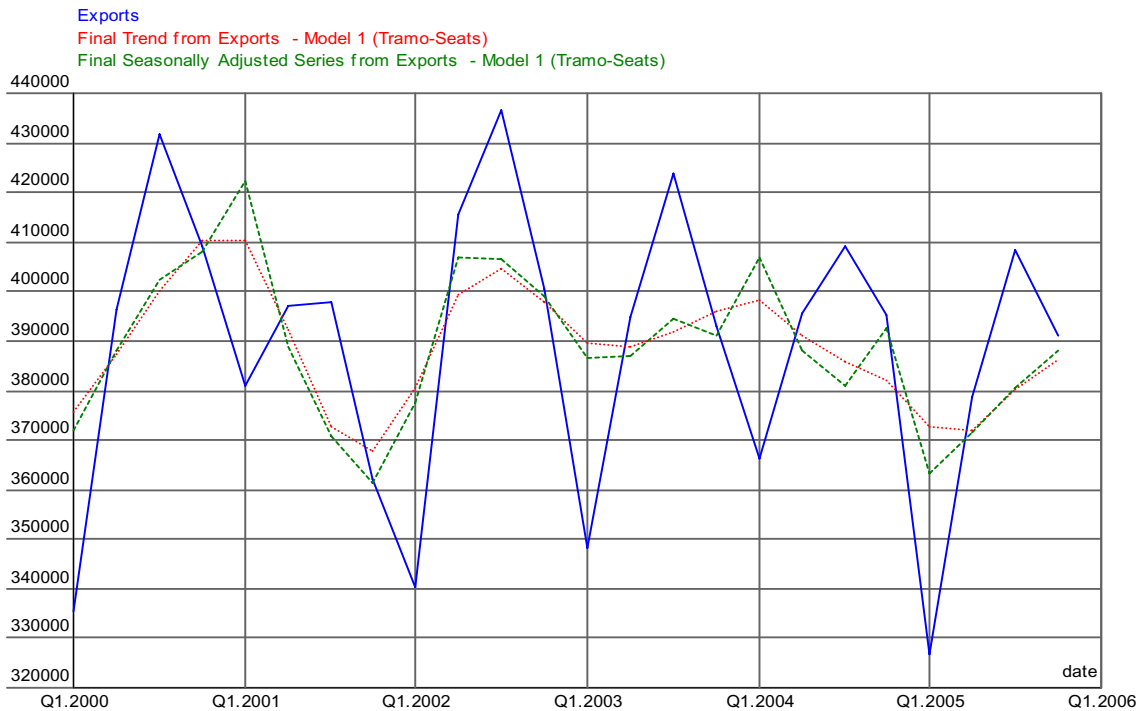
Continuous line: actual data
Dotted line: final trend line
Dashed line: final seasonally adjusted data

Figure 8. Gross Capital Formation at constant prices



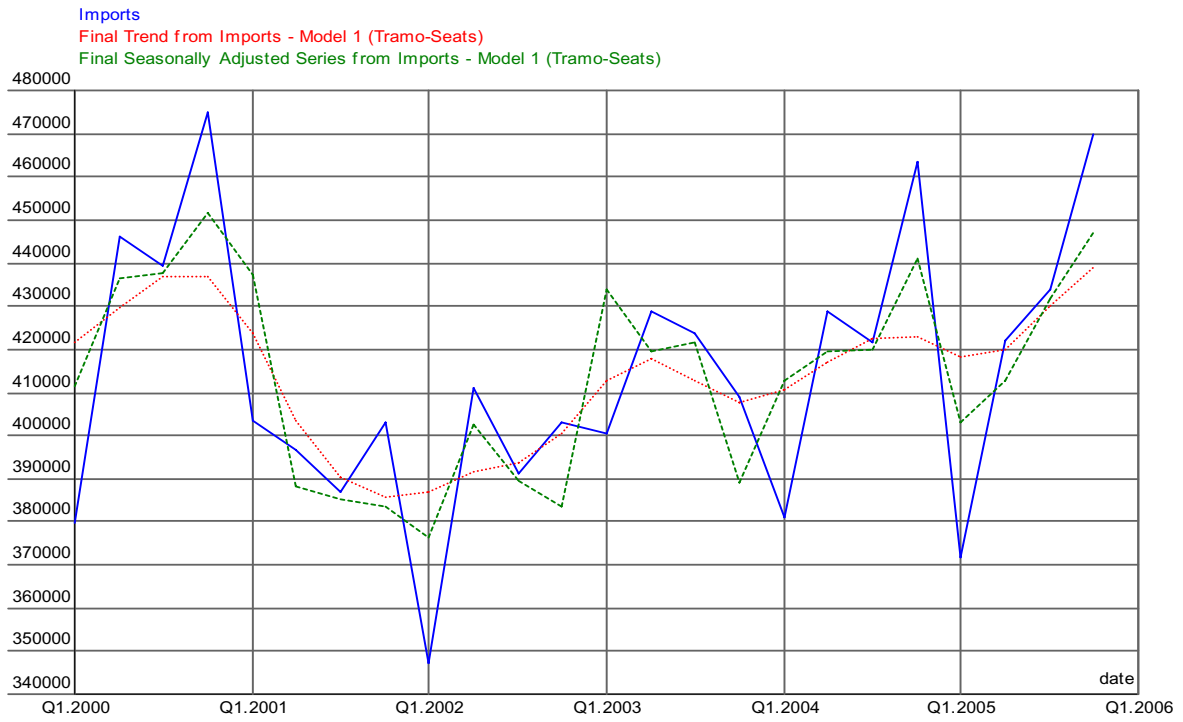
Continuous line: actual data
 Dotted line: final trend line
 Dashed line: final seasonally adjusted data

Figure 9. Exports of Goods and Services at constant prices



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

Figure 10. Imports of Goods and Services at constant prices



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

Figure 11. GDP at current prices

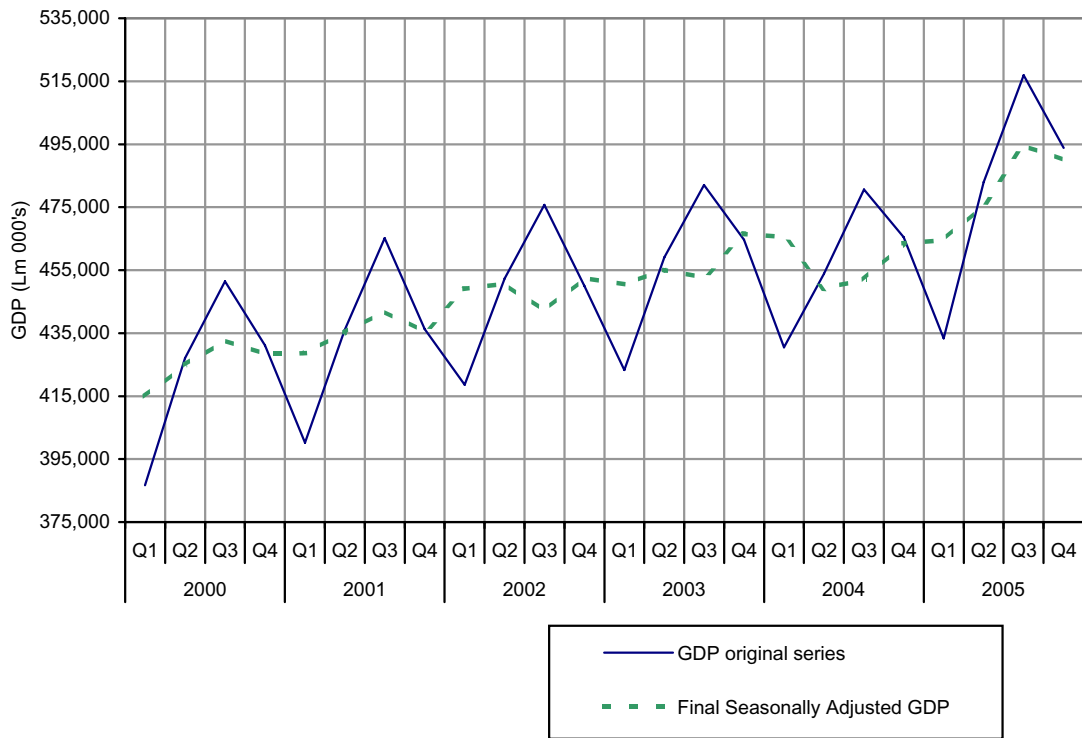


Figure 12. GDP at constant prices

