

Factors Effecting GDP Growth in Member States of the European Union

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Abstract:

This paper investigates the GDP growth in member states of the European Union from 1978 until 2007. As most people are well aware of, GDP is calculated by the sum of consumption, government expenditure, investment, and net exports. The research conducted for this paper intends to discover what other variables have affected GDP growth in the past 30 years. The variables used in this paper include the public expenditure on education, total population, inflation, percentage of population who are adolescents (0-14), adults (15-64), or elderly (65+). Today there are twenty-seven member states in the Union from which I have compiled data on these variables for the past thirty years. (List of member states Exhibit A). After careful observation of these key variables, it can be said that countries in the European Union (E.U.) have their GDP growth affected by other variables which are not in the original equation.

JEL Classification: O52, O57, P24, P33, P52

Keywords: Economic Growth, European Union

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The author gratefully thanks Dr. Ramesh Mohan for his assistance with the completion of this paper.

1.0 INTRODUCTION

The European Union was established in 1951 by Belgium, France, Germany, Netherlands, Italy and Luxemburg. These countries came together to form this alliance because their economies were in shambles following the conclusion of World War II. With this Union in place these countries were able to rebuild themselves by relying on the economies of one another and growing together. The economic model of GDP is known to be $Y = C + I + G + N$, where C is private consumption, I is gross investment, G is government spending and N is net exports (gross exports less gross imports). These inputs vary from country to country and can be influenced by a variety of different things.

One variable which has an effect on the GDP is known as inflation. Inflation is defined as either an increase in the money supply or an increase in the overall price levels. The opposite of this is known as deflation. The inflation rate will affect overall GDP in a couple of different ways. If inflation were to rise then the private consumption would undoubtedly fall because the consumer can no longer afford the same basket of goods they were previously purchasing. This rise will also result in a decrease in the volume of goods which are being exported. Therefore the difference between gross exports and gross imports will narrow and ultimately lower GDP. This paper will discover the correlation between the inflation rate and the level of GDP in the member states over the past thirty years. It is expected that as inflation rises, the overall GDP will decline, but not by the same margin because of the other variables involved in the equation.

Other Variables which contribute to the growth of GDP will be examined in the same way that inflation was dissected. Apart for the basic factors which affect GDP, consumption, investment, exports, government spending, some different variables need to be examined. The first

variable is the population rate of the entire EU. This will tell how many people there are in the area and will show what affect it has on overall GDP. Over the past decade or so, the world's population has continued to grow due to the ever expanding average life expectancy. This can obviously be attributed to all of the advancements which have been made in the medical field. A second variable which will be used is known as the amount of public expenditure on education. This data will allow me to determine if the amount which is being spent on education results in a positive correlation with GDP. I have chosen to use the public expenditure because some countries, such as France, have socialist forms of higher education. This means that in order to attend a university, a person has to take a test which determines where they will go to school. It also means that this education is funded by the government and thus falls under the government expenditure category. The final three variables which were used in this paper include the percentage of the population which falls into certain age brackets. The age brackets are divided into three categories which reflect their ages. I felt that this was important to include because there has been growing concerns about the growing age of the overall population in the E.U. It is widely known that a large percentage of the population will be moving into the elderly age bracket, 65+, in the coming years. In the data used in this paper the percentage of people in this bracket has already grown considerably in comparison to the percentages of the population in the other two brackets, 0-14 and 15-64.

2.0 TRENDS

The overall trend in total GDP from 1998 till 2007 has been a positive one for the member states of the European Union. The table below shows the total amount of GDP for the European Union based on current market prices (EUR 1 000 million) and the percentage share of that GDP which each country produced.

TABLE 1 : GDP (current market price)

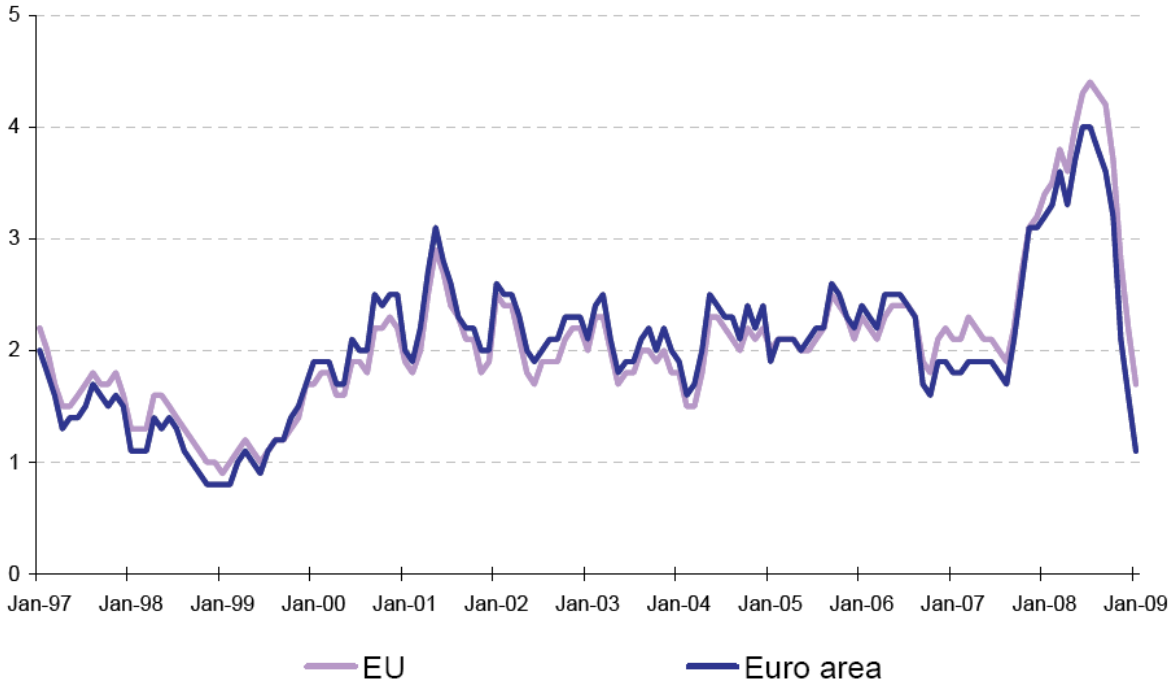
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Share of EU-27, 2007 (%)
EU-27	8 142	8 558	9 173	9 549	9 911	10 077	10 577	11 035	11 641	12 304	100.0
Euro area	6 140	6 422	6 757	7 051	7 299	7 514	7 819	8 109	8 499	8 919	72.5
Belgium	228	238	252	259	268	275	290	302	317	331	2.7
Bulgaria	11	12	14	15	17	18	20	22	25	29	0.2
Czech Republic	55	56	61	69	80	81	88	100	113	127	1.0
Denmark	155	163	174	179	185	189	197	208	220	228	1.9
Germany	1 952	2 012	2 063	2 113	2 143	2 164	2 211	2 243	2 322	2 423	19.7
Estonia	5	5	6	7	8	9	10	11	13	15	0.1
Ireland	79	91	105	117	130	139	149	161	175	186	1.5
Greece	122	132	138	146	158	171	185	199	214	229	1.9
Spain	537	580	630	681	729	783	841	909	982	1 051	8.5
France	1 315	1 368	1 441	1 497	1 549	1 595	1 660	1 726	1 807	1 892	15.4
Italy	1 087	1 127	1 191	1 249	1 295	1 335	1 392	1 428	1 480	1 536	12.5
Cyprus	9	9	10	11	11	12	13	14	15	16	0.1
Latvia	6	7	8	9	10	10	11	13	16	20	0.2
Lithuania	10	10	12	14	15	16	18	21	24	28	0.2
Luxembourg	17	20	22	23	24	26	27	30	34	36	0.3
Hungary	42	45	52	60	71	75	82	89	90	101	0.8
Malta	3	4	4	4	4	4	5	5	5	5	0.0
Netherlands	360	386	418	448	465	477	491	513	540	567	4.6
Austria	190	198	208	212	219	223	233	244	257	271	2.2
Poland	153	157	186	212	210	192	204	244	272	309	2.5
Portugal	106	114	122	129	135	139	144	149	155	163	1.3
Romania	37	33	40	45	48	53	61	80	98	121	1.0
Slovenia	19	20	21	22	24	25	27	28	30	34	0.3
Slovakia	20	19	22	24	26	29	34	38	45	55	0.4
Finland	116	123	132	140	144	146	152	157	167	180	1.5
Sweden	226	241	266	251	264	276	288	295	313	332	2.7
United Kingdom	1 280	1 384	1 573	1 613	1 679	1 616	1 745	1 805	1 913	2 019	16.4
Croatia	19	19	20	22	24	26	29	31	34	37	0.3
FYR of Macedonia	3	3	4	4	4	4	4	5	5	5	0.0
Turkey	239	234	290	218	243	268	315	387	419	479	3.9
Iceland	7	8	9	9	9	10	11	13	13	15	0.1
Liechtenstein	:	3	3	3	3	3	3	3	:	:	:
Norway	135	149	183	191	204	199	208	243	269	284	2.3
Switzerland	244	252	271	285	296	288	292	299	310	312	2.5
Japan	3 448	4 102	5 057	4 580	4 162	3 744	3 707	3 666	3 485	3 197	26.0
United States	7 802	8 696	10 629	11 309	11 072	9 690	9 395	9 985	10 496	10 075	81.9

Source: Eurostat (tec00001), CH: Secrétariat de l'Etat à l'Economie / JP: Bureau of Economic Analysis / US: Economic and Social Research Institute

The overall trend of the GDP growth in the European Union can be attributed partly to the strength of the Euro in recent years. This is evident because the table also shows the GDP growth of the United States which was on the rise until the devaluation of the dollar at the end of 2002.

The table pictured below shows the average inflation rate for all of the member states of the European Union. As one can see the inflation rate has been on a general uphill climb right until the end of 2009. The inflation dramatically drops off at this point which is definitely a positive thing for the E.U.

TABLE 2: Inflation Rate



Source of Table: Eurostat

Another trend which economists are predicting to occur in the near future deals with the ageing of the population in Europe. The governments are going to be facing challenges which will impact their overall tax revenue because the elderly are not generating any income. The ageing population is expected to follow trend and actually increase their social spending. The problem with this fact is that these ageing people will begin to retire and therefore will not be paying taxes on any income because they won't be earning any. The table below shows the percentages of the

population which fall into each of the three categories from 1999-2007. As one can see the general trend has been an increase in the 65+ age bracket which results in a decrease in the other two brackets.

TABLE 3: Population Breakdown

AGE	1999	2000	2001	2002	2003	2004	2005	2006	2007
0-14	16.505	16.343	16.198	16.044	15.909	15.787	15.681	15.592	15.518
15-64	67.309	67.262	67.195	67.112	67.016	66.919	66.826	66.739	66.653
65+	16.184	16.394	16.614	16.843	17.073	17.293	17.492	17.668	17.828

Source: EuroStat

The final trend which needs to be discussed is the public expenditure on education. From 1999-2007 the percentage of government expenditure spent on education has been remained relatively stable. There have been some minor fluctuations but no really major changes in this time period. The table below shows the percentage of government expenditure spent on education during this time.

Table 4: Public Expenditure on Education

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007
Expenditure	11.450	11.3833	11.2511	11.145	11.189	10.991	11.157	11.341	11.563

LITERATURE REVIEW

Ever since the inception of the European Union in 1951, economists have been very interested in the ways in which the E.U. is conducting business. It is obvious that the member states will have an advantage when it comes to trading with one another in all aspects. This means that they are allowed to move products, technology and labor freely across their borders. There have been many hypotheses which support the idea that the ability mentioned above is the best thing which could happen to these countries. Another common idea about the E.U. is that these countries are experiencing real convergence. Cuadrado-Roura (2001) found empirical evidence which shows that after a period of relative convergence in GDP the process basically disappears. It is stated in their paper that the two possible explanations for this are the “national effect” and the “differential” behavior of different regions in terms of an economic sense.

On the contrary to that belief, Greenaway et al. (2000) found that in two thirds of the cases they studied there were smooth transitions and GDP growth. They attributed this GDP growth to the fact that these regions had joined the European Union and convergence took place. Zaman (2008) conducted a study, which is much more up to date than the two previous ones, which explained the effects of the central and eastern European countries joining the E.U. This paper shows how an entire region is affected by joining the European Union and it also provides evidence of how new countries contribute to the existing ones in the Union as well.

Barell and Pain (1997) investigated the influence of foreign direct investment, the human development index and technological change on GDP growth in the European Union. They found that the union members were able to control FDI from countries outside the union by charging

higher tariffs. This results in the host country making more money off taxes and thus benefits the entire union. Inside the fortress, the countries can invest in other countries but it is basically just investing in themselves. The most important factor when dealing with the European Union has to do with inflation. Arai et al. (2004) stated that in order for the member countries to continue to grow, they must control the amount of inflation. There are levels which inflation must stay under in order for it to not have an adverse affect on GDP.

3.0 DATA AND METHODOLOGY

The data used in this regression study has been collected from many different sources. The main source for the data which was used in this research was acquired mostly from the EuroStat database. This was the best place to find the data because EuroStat has the records of all the countries which are members of the European Union since its inception in 1951. Other economic indicator data was compiled from the World Development Indicators (WDI) database. The World Development Indicators are included in the World Development Report which is published every year. By combining these two sources of economic data, I was able to compile accurate research about the following; overall GDP, percentage of annual change in GDP, public expenditure on education, inflation rate, total population, and the percentage of the population which are in different age brackets. By compiling data from these reliable sources, I was able to be confident that the results of my regression would be as accurate as possible.

3.1 Empirical Model

$$GDP = \beta_0 + \beta_1 POP + \beta_2 POK + \beta_3 POA + \beta_4 POE + \beta_5 PEE + \beta_6 INF$$

GDP is total market value of all goods and services produced by all members of the European Union in a given year. GDP is the dependent variable in this multivariate regression model because the study is aimed at discovering what effects the independent variables have on GDP. The normal model for calculating GDP is commonly known as, $GDP = C + I + G + N$, therefore the model used in this study is vastly different than the normal model. There are many different variables which can contribute to the fluctuations in the amount of GDP in any given year. In this study the six independent variables used include the total population, percentage of population which falls into three different age categories (0-14, 15-64, 65+), public expenditure on education, and inflation. The multivariate regression model used in the study will show the relationship between the dependent variable, GDP, and the six independent variables. The dependent variable, GDP, is expressed as the combined total amount of GDP for all of the countries in the European Union in the thirty year time period from 1978-2007.

The first independent variable used in the model is the combined total population for all twenty seven countries of the European Union in the specified time period. This variable is denoted as POP in the regression model. The second independent variable in the model represents the percentage of the population which is between the ages of zero and fourteen. This variable is denoted as POK which means percentage of kids. The reason why this age group was selected to be used was because the people who are of this age in the population are not yet of working age. This means that they were not contributing to the economic growth, GDP, during the time that they were in this age bracket. Therefore, it seems that if the percentage in this category grew, the GDP would be negatively impacted because that means that there is a lower percentage available to make a contribution to growth. The third independent variable in the model represents the percentage of the population which is between the ages of fifteen and sixty-

four. This variable is denoted as POA which is intended to mean percentage of adults. This age group was included because they are the ones which are actively contributing to the GDP growth of the Union. It is assumed that most of the people in this category are working adults, even though there definitely are a percentage of them who are unemployed, disabled, or still continuing their education. It is assumed that if the percentage of adults in the population is larger, then GDP will also be larger because there are more people contributing to growth. The fourth independent variable represents the percentage of the population which is of the age sixty-five or older. This variable is denoted as POE which is intended to mean the percentage of elderly. This variable is important to include because like the POK, these people are not actively contributing in the production of goods and services. The commonly accepted retirement age is sixty-five in most areas around the world. However, this cut off age has been rising due to the mere fact that people cannot afford to retire at this age because they do not have enough money saved to continue to support themselves. The one problem with this variable is that it doesn't account for the people who are still employed due to the fact that they simply cannot afford retirement. It can be assumed that the population of elderly people will have a negative correlation with GDP because there will be less people contributing to growth.

The fifth independent variable represents the percentage of government expenditure spent on education or the amount of public expenditure on education in a given year. This variable is represented by PEE which is intended to mean public expenditure on education. One would undoubtedly hope that as this percentage rises, GDP will rise also. If the public is having their tax dollars spent on furthering the education of the citizens of the European Union, then they are hopefully receiving the benefit of experiencing a positive correlation between the expenditure and GDP. The sixth and final independent variable represents the inflation rate for the given

year. This variable is denoted in the model as INF. Inflation can be defined as a rise in the general level of prices of goods and services over a period of time. The inflation rate affects how much consumers are going to be willing to purchase because the buying power of the currency they possess will be weakened. It can be assumed that the inflation rate will have a negative correlation with the amount of GDP.

3.2 Data

This study uses data from all member states of the European Union combined annually from the thirty year time period of 1978 up until 2007. The first source of data used in this regression was compiled from EuroStat whose primary function is to keep records of all the combined data from the European Union. The second major source of data used is from the World Development Indicators which are published in the World Development Report every year. In certain circumstances the data for public expenditure on education was not available so in order to fill in the missing fields the average of the previous year and the following year was used. The table below shows all of the summary statistics for the data used in this study. It should be noted that public expenditure on education (PEE) is expressed as the percentage of government expenditure spent on education. It should also be noted that the age brackets are expressed in terms of the percentage of the total population which they represent.

Table 5: Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
GDP	30	5.74 E+12	2.78 E+12	2.12E+12	1.23E+13
INF	30	4.694663	2.891653	2.233400	11.82650
PEE	30	10.61844	.618841	9.15	11.56320
POA	30	66.73187	1.064630	63.76910	67.46490
POE	30	15.06133	1.561244	13.19840	17.82810
POK	30	18.20681	2.188816	15.51870	22.77780
POP	30	3.05 E+8	9556313	2.91 E+8	3.24 E+8

4.0 Empirical Results

In order to achieve the desired results two different regressions had to be run. This is because the two variables, POK and POE, were too similar and therefore presented the problem of co linearity. In both regressions which were run, there were four variables which were significant at the one percent level, one that was significant at the ten percent level and two which were not significant at all. The first variable which was significant at the one percent level was inflation. In both regressions it produced a negative coefficient which means that as the level of inflation increases, the total amount of GDP will decrease. This result does not come as a shock to anyone because it is fairly obvious that as inflation rises, the total private consumption and total amount of net exports is going to decrease. This variable was basically used as a dummy variable to be sure that the regression results were on the right track because if it had come out to be a positive correlation, then something was probably wrong. The second variable which is significant at the one percent level was public expenditure on education. In both regressions this variable produced a positive coefficient which means that it positively correlates with GDP. The public can now rest a little more at ease because it has been proven that the tax dollars contributed to education results in an increase of GDP. The third variable which is significant at the one percent level is the population of adults. One again this result was basically a given seeing as the people which fall into this age category are the ones who are contributing the most to GDP. This was also the only variable which was different between the two regressions, but it was significant at the one percent level in both. The final variable which is significant at the one percent level is the total size of the population. The results show that the total population number positively correlates with the total amount of GDP.

The two variables which were not significant in this regression include the percentage of population who are adolescents or elderly. This result was kind of a shock to me because I thought for sure that these two groups would both have a negative impact on GDP. I have reviewed the data collected for this study and looked at the forecasted population statistics for the next fifty years which allowed me to reach one conclusion. The percentage of elderly people in the population has not yet increased to the numbers which will affect GDP. According to the graphs in Exhibit B, the population categories are expected to change rapidly in the coming years. When the numbers begin to get so distant from one another with the percentage of adults shrinking and percentage of elderly rapidly increasing, then I think POE will have a negative correlation with GDP.

Below is the table which has come directly from the two multivariate regressions which were run using the e-views software. As one can see, both of the regressions resulted in almost the exact same numbers except for the switching of POE, POK, and the minor differences in the results for the POA variable.

Table 6: Multivariate Regression Results

Dependent Variable: GDP
 Method: Least Squares
 Date: 04/10/10 Time: 12:26
 Sample: 1978 2007
 Included observations: 30

	Coefficient	Std. Error	t-Statistic	Prob.
INF	-3.52E+11	1.09E+11	-3.219182	0.0037
PEE	1.05E+12	2.96E+11	-3.554932	0.0016
POA	1.08E+11	4.30E+11	-0.250218	0.0045
POK	-7.38E+11	5.13E+11	1.437924	0.1634
POP	416705.0	88110.92	4.729323	0.0001
C	-1.15E+14	6.26E+13	-1.834221	0.0790

R-squared	0.958941	Mean dependent var	5.74E+12
Adjusted R-squared	0.950387	S.D. dependent var	2.78E+12
S.E. of regression	6.19E+11	Akaike info criterion	57.31741
Sum squared resid	9.20E+24	Schwarz criterion	57.59765
Log likelihood	-853.7611	Hannan-Quinn criter.	57.40706
F-statistic	112.1053	Durbin-Watson stat	1.273144

Dependent Variable: GDP
 Method: Least Squares
 Date: 04/10/10 Time: 12:29
 Sample: 1978 2007
 Included observations: 30

	Coefficient	Std. Error	t-Statistic	Prob.
INF	-3.52E+11	1.09E+11	-3.219216	0.0037
PEE	1.05E+12	2.96E+11	-3.554952	0.0016
POA	8.45E+11	2.72E+11	-3.111719	0.0048
POE	-7.38E+11	5.13E+11	-1.437969	0.1634
POP	416707.3	88109.83	4.729407	0.0001
C	-4.11E+13	2.02E+13	-2.031862	0.0534

R-squared	0.958941	Mean dependent var	5.74E+12
Adjusted R-squared	0.950387	S.D. dependent var	2.78E+12
S.E. of regression	6.19E+11	Akaike info criterion	57.31740
Sum squared resid	9.20E+24	Schwarz criterion	57.59764
Log likelihood	-853.7611	Hannan-Quinn criter.	57.40705
F-statistic	112.1059	Durbin-Watson stat	1.273126

5.0 Conclusion

The purpose of this study was to take the original equation for GDP and create a new one which included variables not previously studied. There have been other studies which include other variables that focus on affecting one specific aspect of the original GDP equation such as the percentage of government expenditure spent on a variety of different things. This study is different than those because it was aimed to investigate the effects these variables had on the overall GDP total for the entire European Union. As stated in the empirical results section, I was surprised to see that the percentage of elderly people in the population was not a significant variable at this time. If this study were to be performed fifty years from now, with the current numbers of GDP during that time, I believe that it would definitely have a significant impact. One positive note which can be taken away from this study is that the public expenditure on education does in fact have a positive correlation with the overall total of GDP. This can reassure the public that their hard earned dollars which they contribute to taxes has been resulting in a positive correlation with GDP. If this study was conducted again in the future, I believe that the total amount of private expenditure on education should be included. This variable should definitely be included if the study was to be conducted for the United States. I believe this because in the United States, the private expenditure number is much more significant than in the European Union because we do not have very many publicly funded University programs. The majority of college students in the United States pay their own way through college.

There are many different other variables which can be studied in future regressions which I am sure will have effects on the overall total of GDP. When I revisit the idea concerning the percentage of the population which is elderly, I can produce one other basic conclusion. I believe that the problem with the population moving into the elderly range does not only concern the fact that they will not be contributing to the overall production of GDP. The main problem which comes to light with the ever growing population of elderly deals with the costs which will be associated with their healthcare. More and more people are going to need care which they will need government funding to support. The amount of money which is contributed to that care will have a negative impact on the overall GDP because government expenditure will be on the rise. I

will look to future studies and perhaps by conducting one of my own to discover what the implications are which exist with the growing age of the population. As one can see in Exhibit C, I expected that the variables INF, POE, and POK would have a negative sign in relation to GDP which did not hold true in this study. INF did hold true and it was proved to have a negative correlation with GDP. On the contrary, POE and POK did not have a significant negative impact on GDP even though they did have negative coefficients. I also predicted that the variables, POA, PEE, and POP would have a positive correlation in relation to GDP. This assumption did hold true with the regression analysis as all three of these variables produced a significant positive correlation with GDP.

Exhibit A

Member states of the European Union (27 total)

Austria	Finland	Latvia	Romania
Belgium	France	Lithuania	Slovakia
Bulgaria	Germany	Luxembourg	Slovenia
Cyprus	Greece	Malta	Spain
Czech Republic	Hungary	Netherlands	Sweden
Denmark	Ireland	Poland	United Kingdom
Estonia	Italy	Portugal	

Exhibit B

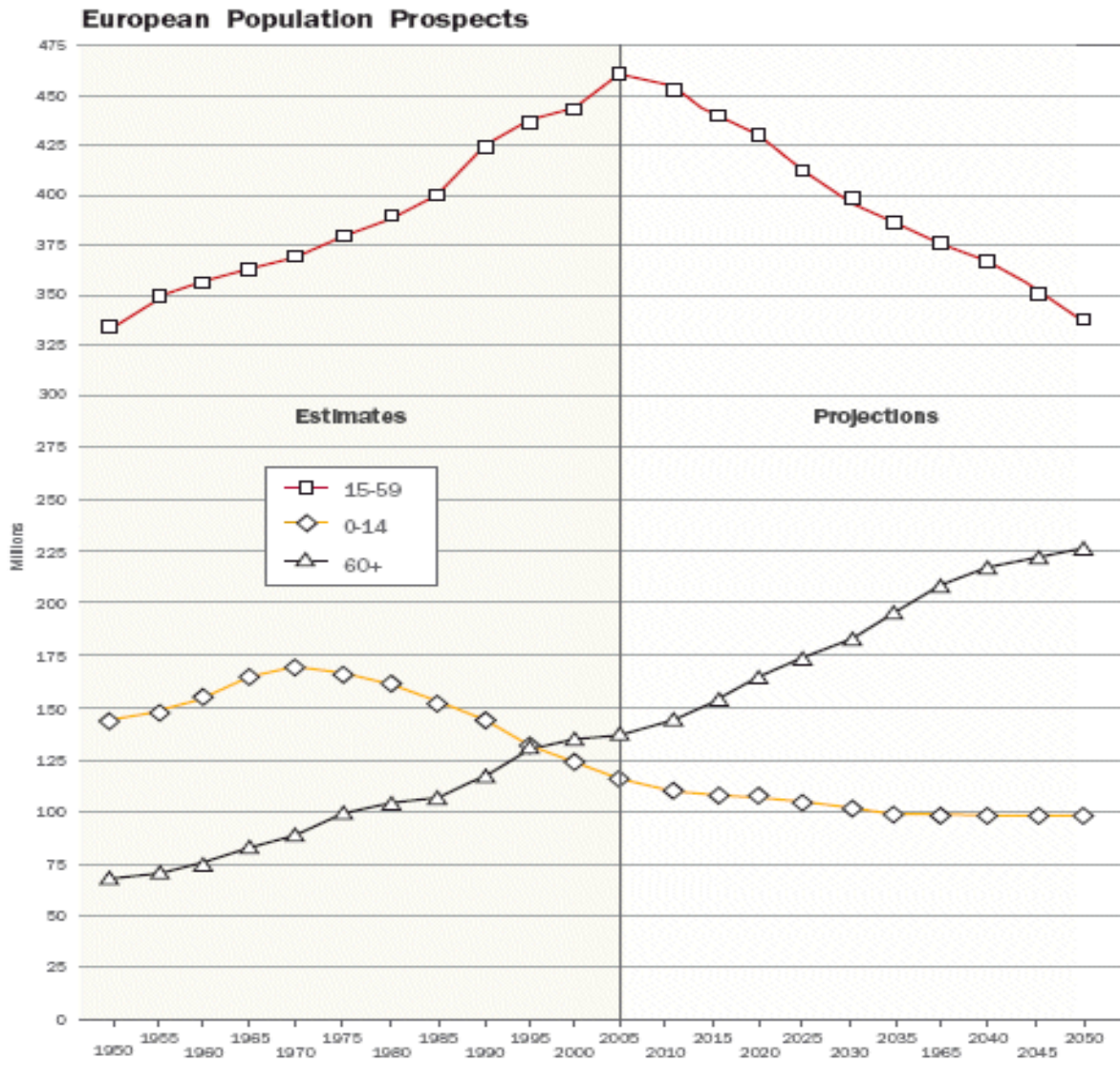


Figure 1. Europe's population by age groups, 1950-2050. The projections demonstrate the reason for companies like Genpact looking at alternative outsourcing destinations.

Source: UN, 2006 revision of World Population Forecasts

Source: UN, 2006 Revision of World Population Forecasts

Exhibit C

Variable	Description	Source	Expected Sign
INF	Inflation Rate	EuroStat, WDI	-
PEE	Percentage of government expenditure on Education	Eurostat	+
POA	Percentage of Adults (15-64)	EuroStat	+
POK	Percentage of Adolescents (0-14)	EuroStat	-
POE	Percentage of Elderly (65+)	EuroStat	-
POP	Total Population	EuroStat	+

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