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Exploring the Dynamics and Modeling National Budget as a Supply Chain System: A Proposal for Reengineering the Budgeting Process and for Developing a Management Flight Simulator

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EXPLORING THE DYNAMICS AND MODELING NATIONAL BUDGET AS A SUPPLY CHAIN SYSTEM: A PROPOSAL FOR REENGINEERING THE BUDGETING PROCESS AND FOR DEVELOPING A MANAGEMENT FLIGHT SIMULATOR

THESIS

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AFIT/LSCM/ENS/12-07

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THESIS

Presented to the Faculty

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In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Supply Chain Management and Logistics

Christoforos Kalloniatis

Captain, Hellenic Army

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Approved:

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Dr Cooper Martha (Member)	Date

Abstract

In the Science of Economics, there has been a debate about the optimal fiscal and budgetary policy that should be implemented by governments. On the one side, the advocates of the Keynesian Theory assert that in recession times governments should run budgets with deficits, in order to stimulate the economy, while the supporters of the Balanced Budget Theory, on the contrary, underscores the need to reduce and even eliminate the budget deficits. However, previous experience shows that both theories can fail to accomplish their goals, because they underestimate a very sensitive parameter: national budgets are not just an estimate of revenues and receipts or a simple statement. Rather, they are systems, the entities of which interact with each other and respond to any event affecting their state. Even further, a national budget can be considered as a special case of a supply chain system.

Within this framework, the present thesis seeks to introduce a new aspect in budgeting. Specifically, the national budget is mapped as a supply chain and modeled as a system. Thereafter, the research focuses on and explores the budget's dynamics, which are responsible for the failures experienced in the fiscal and budgetary policy and concludes with a proposal for reengineering the budgeting process, according to the postulates of the demand management process in a supply chain. Lastly, it underscores the need to develop a Management Flight Simulator, which will reveal the dynamics of national budgets, as the Beer Game does in the case of the supply chains, and that will act as a learning tool for anyone interested in budgeting, supply chains or/ and public economics.

To my wife and our daughter

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Lastly, and most importantly, my deepest gratitude and love to my wife and our daughter for all their patience and understanding, and to my parents for their lifetime support.

Christoforos Kalloniatis

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I. Introduction

General Issue

In general terms, a Budget can be defined as an "estimate of revenue and expenditure for a specified period" (Downes & Goodman, 2006). A special case of a Budget is the National, Government, Public, or Federal Budget which the Oxford Dictionary of Economics (Black, Hashimzade, & Myles, 2009) described as "a statement of a government's planned receipts and expenditures for some future period, normally a year. This is usually accompanied by a statement of actual receipts and expenditures for the previous period......The word budget originally meant the contents of a package; the budget is so called because it brings all the government's tax and spending plans together. ...". A budget has a surplus when government's receipts exceed the total expenditure or a deficit when the expenses are greater than the revenue. In the case of equality between the receipts and the expenditure, the budget is called balanced. Although before the Great Depression, it was generally accepted that the budget should be balanced, Keynes proposed that budget deficits may be desirable in periods of recession to stimulate the economy (Stiglitz, 1986, p. 46). This approach as well as a number of other factors, such as the governments' failure to implement successfully their economic-tax policy and/or the deviations between the actual and expected (budgeted) expenses - receipts in the implementation stage and/or the inefficient use of the capital borrowed, led governments to "run" budgets with deficits.

Budget deficits are financed mainly by borrowing (loans) and the total value of government loans determines the country's national or public debt (Stiglitz, 1988). A

deficit is not a static variable in the public debt's formation; on the contrary, it is a dynamic element, because of the interest that the governments have to pay to their creditors or/and due to the need for "re-borrowing" in order to finance liabilities that mature. The continuous governments' trends to form and execute budgets with deficits led to a situation where most of the countries (if not all) have to show at the present time an, outstanding or not, amount of public dept.

Problem Statement - Research Objectives

Nowadays, sovereign debt has evolved into one of the most serious problems that many governments have to solve and has been one of the main causes of the "crisis" that the world economy faces. The current situation is highlighted by the debt crisis in the Eurozone, the first, in history, US Federal Government's downgrading concerning its credit rating by Standard and Poor's (5 August 2011) and the International Monetary Fund's financial help to even more countries that have been unable to finance their budgets by borrowing the needed funds from the capital markets. Figure1 depicts sovereign debt for 2012 and reveals that it is the U.S., Canada, Japan, and (some of) the EU economies that are exposed to debt in higher levels than any other countries.

There is a plethora of "philosophies" and recommendations concerning the public debt's management. Some of these proposals involve the devaluation of the national currency, stricter economic policies, austerity measures and plans, even defaults. On the other hand, advocates of the Keynesian economics claim that the solution is to stimulate the economy, even if that means even higher levels of debt and the maintenance of running budgets with deficits.

-2-
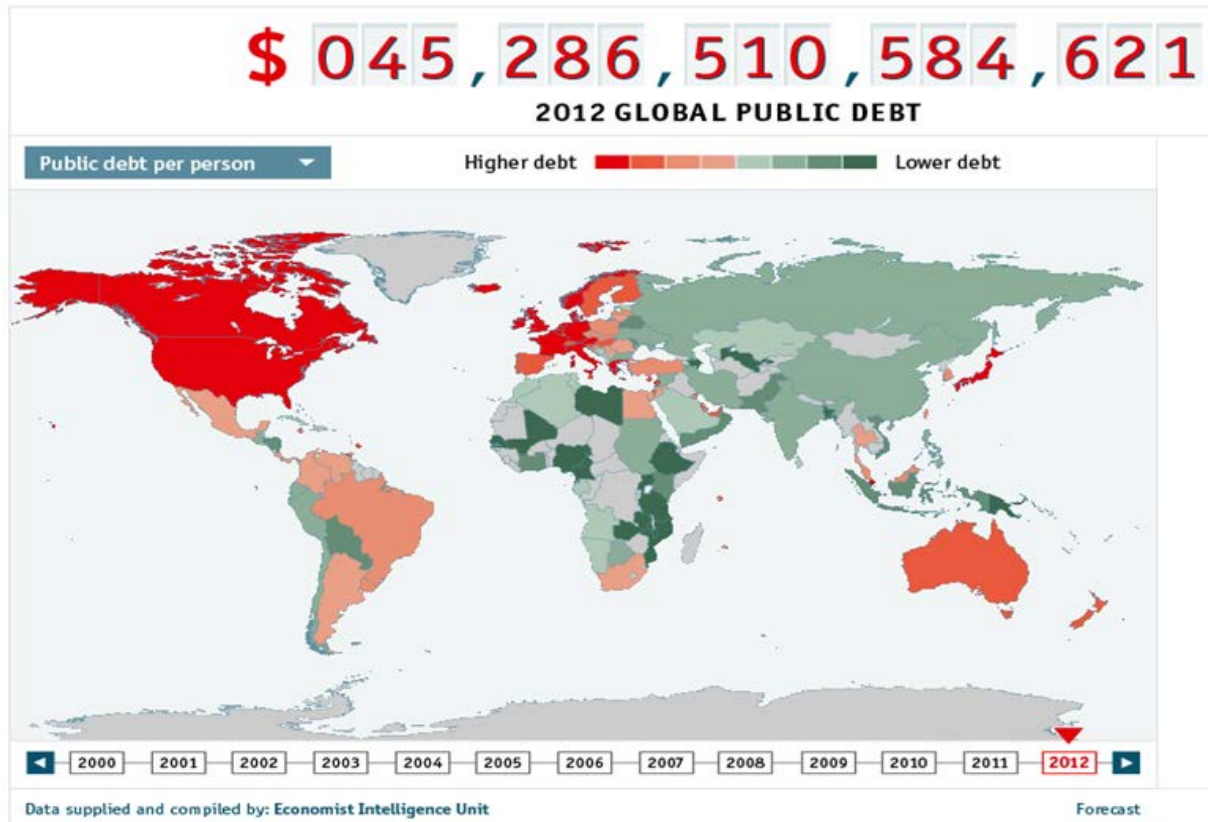
Figure 1. The Global Debt Clock (The Economist)

Within this framework, the present thesis approaches the national budget as a supply chain system and seeks to identify its dynamics which can lead both the Keynesian theory and the Balanced-Budget approach, to fail in addressing the deficits and public debt issue when implemented, and second to suggest a general framework of budgeting, which could help face these failures. Specifically, a proposal is introduced for reengineering the budget process, based on the supply chain demand management process principles of operations and it is introduced the idea of developing a Budget Management Flight Simulator, by utilizing systems dynamics, which will reveal the

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complexity of budgets and the causes of fiscal policy failures, and will act as a learning tool for anyone interested in public economics.

In order to achieve its research objectives, this study first approaches and maps the national budget from a supply chain perspective, which depicts the relationships between the budget's entities as well as the structure of the fiscal and budget system. The supply chain map is then used, as a basis for modeling a budget as a complex and dynamic system. Thereafter, the budget's dynamics are identified by utilizing systems theory and the reasons that cause failures in the systems are acknowledged, in both the Keynesian and the Balanced-Budget case. Finally, a general framework of forming, implementing auditing budgets is initialized and, using the principles of systems dynamics, a proposal for the development of a Budget Management Flight Simulator, that will operate as a learning and educational tool, is introduced.

Assumptions/Limitations

The present thesis should not be considered as a research effort for optimal budget policy or optimal level of debt, which are issues that have been extensively discussed in the literature by economists, without reaching an agreement. Rather, it should be considered as an effort to identify the reasons that budget policies fail to address the deficits and public debt issues and as a proposal for a new framework for budgeting. However, a review of the extensive literature concerning the budget deficits – public debt issue was found necessary in order to model the national budget as a supply chain, to show how economic thought evolved from balanced budgets to financing economy with deficits and lastly to demonstrate the rationale which shaped the current *status quo* of

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excessive sovereign debt and led many countries to run, especially in the later 20 years, budgets with deficits.

Preview

The present chapter defines the problem and research objectives of this study, as well as the assumptions and limitations that were made. Chapter II provides an extensive review in the literature on the issues of budget deficits, public debt, supply chain, systems theory and systems dynamics that are related to this research thesis. In Chapter III, the national budget is mapped as a supply chain, and Chapter IV presents it as a system and explores its dynamic elements and characteristics. Chapter V includes a proposal for reengineering the national budget's process and suggests the development of a Management Flight Simulator. Finally, Chapter VI presents the conclusions of this thesis and includes recommendations for further research.

II. Literature Review

National Budget

A budget, in general terms, is, as aforementioned, an "estimate of revenue and expenditure for a specified period" (Downes & Goodman, 2006), or according to the IMF Glossary of Selected Financial Terms (2006) as "a statement of the projected revenues, proposed expenditures, and planned financing of any surplus or deficit of an entity, especially government". Research in this thesis focuses on government budgets which usually cover a 12-month fiscal year period and may or may not match with a calendar year. Stiglitz (1986, p. 47) parallelized them with the corporations' income statements and pointed out that they give a picture of the sources and the destinations of the money a government collects and spends, respectively, adding that it is a measure of a government's cash flow, receipts and expenditure, too. However, a budget is not only a descriptive statement of receipts and expenditure. Hackbart and Ramsey (2002, p.11) "saw" budget as "a reflection of and the means by which the basic goals of the government and society are achieved", while Burkhead (1956) acknowledged a budget as a "major weapon for instilling responsibility in the governmental structure" by bringing public the government's actions and destroying "the rule of invisible government". In parallel, Mussel (2009) stated that the budget is an instrument for governments to apply their economic policy, a means of public relations, and that the purposes a budget serves include the limitation and direction of governments' activities and the effort to hold them accountable. From another view, budgetary policies target an efficient allocation of resources with the limitation of distributing the income fairly and to a stable

macroeconomic environment (OECD, 2012). Socially speaking, Caiden (1998) included in the duties of government professionals (budget is formed and implemented by them) the protection of the helpless, the service to the society by defending justice, the environment's protection, and the improvement of the health and the welfare of the public.

Structurally, a budget is a cyclical process consisting of four stages (Mussel, 2009). The first is preparation, where an extended forecast takes place concerning the revenue and the expenses for the year that the budget concerns. This procedure is usually conducted by special government offices and departments, like the Office of Management and Budget in the U.S. or the Ministry (Department) of Finance in other countries. It must be mentioned that the agency responsible for preparing the budget usually issues detailed instructions to all other government entities that are related to this stage and asks the information sent by them to be in a certain format, because of the amount of data gathered and time restrictions. The second stage is the approval of the budget by a legislative body, like the Parliament or the Congress. After approval, the budgets move to the implementation stage, which mainly involves collecting the revenues and financing the activities of the budget. This stage contains all the actions which make sure that the funds released by the government are spent for the purposes and the amounts stated in the budget. Cash and debt management as well as essential adjustments in budget plans are other activities that are associated with the implementation stage. Lastly, the review stage consists of all the actions related to audits concerning the budget.

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┌─────────────────────┐
│    Preparation      │
└─────────────────────┘
          ↓
┌─────────────────────┐
│     Approval        │
└─────────────────────┘
          ↓
┌─────────────────────┐
│   Implementation    │
└─────────────────────┘
          ↓
┌─────────────────────┐
│      Review         │
└─────────────────────┘
```

Figure 2. The four stages of a National Budget

Budget Surplus – Deficits

The budget surplus is defined as the excess of the revenues collected by the government during a period of time (usually one year), over its total spending, while a budget deficit is a negative surplus and indicates the level that the government's revenues fall short of its expenditure. The budget surplus is given by the following equation (Dornbusch, Fisher, Startz, 1998):

Equation 1. Budget Surplus/Deficit

$$BS = TA - \overline{G} - \overline{TR}$$

where budget surplus is denoted by BS, $\overline{TR}$ are the government's transfer payments , $\overline{G}$ is the amount of government's purchases of goods and services (spending) and TA is the

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revenue raised by taxes. When a deficit exists, government fills the gap between expenses and receipts. There are mainly two potential sources of funds that can be used to finance budget deficits. First, the government can borrow the funds needed and create debt by issuing and selling bonds, which is a part of its fiscal policy and second, the deficit can be financed by printing money, which is a means of monetary policy. This relation is shown by the Government's Budget Constraint (GBC), which is expressed with the following equation (Kelton, 2011):

Equation 2. Government Budget Constraint

$$G + iB^{Non-Govt} = \text{T} + \Delta B^{Non-Govt} + \Delta \text{M}$$

where G is the non-interest spending of the government, $iB^{Non-Govt}$ is the interest paid due to the national debt that is held by non-governmental entities, T is the revenue raised from taxation, ΔM denotes the change in the monetary base and finally $\Delta B^{Non-Govt}$ is the change of the quantity of the government bonds held by the non-governmental entities. The difference between spending G (outlays minus the interest) and taxes T (revenues) is the primary deficit or surplus. What GBC mainly shows is that the budget deficit, which equals spending (G) plus interest paid for bonds ($iB^{Non-Govt}$) minus tax receipts (T) is covered either by borrowing (an increase in government's bonds denoted by $\Delta B^{Non-Govt}$) or by expanding the monetary base ΔM (printing money). The later phenomenon, namely when the central banks print money to purchase a part of the government's debt, is known as "monetization" of deficits. Analyzing further the GBC equation we conclude

that a deficit in a national budget results in higher taxes and/or higher growth of money and/or lower spending, in the future (Barth & Wells, 1999). It should be noted that some economists (i.e. Dornbusch & Fischer, 1990) include in the GBC more sources of revenue for the government (i.e. revenue from the privatization of companies that belong to government), but creating debt and/or "monetization" of deficits are acknowledged as the usual methods of financing budgets.

Budget deficits are mainly financed by the private sector (Mankiw 2010). In particular, when needed, government issues bonds and sells them to investors in order to cover the gap between expenditure and receipts. The creditors' profit is the interest they earn from purchasing the government's bonds. However, nowadays, the private sector is not the only borrowing source for governments. For countries that have been facing severe problems with their public economics, the International Monetary Fund (IMF), an organization with the participation of 188 countries that was established in order "to foster global monetary cooperation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty around the world" (IMF, 2012), has been a source of financial funds, too. Additionally, the recent world financial crisis triggered the establishment of the European Financial Stability Facility (EFSF) by the euro area Member States, on 9 May 2010. EFSF, which is a mechanism that helps countries participating in the Euro with financial problems, (deficits, high debt), will be substituted by the European Stability Mechanism (ESM), which is going to serve the same purposes. Lastly, but less usual, another way for a

government to finance its budget is by intergovernmental agreements for loans, under which it borrows the funds needed from another country.

A second option for governments to finance budget deficits, besides borrowing is just to monetize debt. However, this method has been widely criticized in the literature, because of its effects to the economy, such as the increase of inflation. In an extreme approach, Barth, Iden, and Russek (1986) considered monetization as "an indirect default to the extent that the monetization leads to inflation which erodes the value of outstanding debt". Within this framework, Mankiw (2010, p.487) stated three reasons that monetary policy is not used to address the problem of debt: First, he supported that printing money is unnecessary as long as a government can sell debt, second central banks have enough power to refuse to implement such policies and last but most important, policymakers acknowledge that fiscal problems cannot be solved with inflation. Worth mentioning that monetization of debt, namely the extent to which a central bank finances the government's deficit, depends on the level of its independence; there are countries where governments have almost full authority over the country's central bank and others where central banks "enjoy" higher levels of independence.

Measuring Budget Deficit

The absolute value of the budget deficit (in currency units) cannot be considered as a reliable measure of economic welfare, *per se*, for a number of reasons. In other words, an economy with low or no deficits is not necessarily a prosperous economy. For instance, underdeveloped countries or countries that have high national debt which strengthens the possibility of a default or countries that experienced a default in the near

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past and their economies have not recovered yet, usually lack the ability to run budgets with deficits because of their inability to borrow financial funds from the world's capital and credit markets. Moreover, each country's deficit in monetary units depends on a number of factors i.e. the economy's size - larger countries usually have higher needs for funds to finance their budget. Under these conditions, the yardstick commonly used nowadays to measure and to compare the budget deficit for a year is the ratio of the deficit to the nominal GDP (both in monetary units) for this specific year. However, for many economists even this index is insufficient and some of them (i.e. Rosen, 1992; Mankiw, 2010) mentioned their concern about the traditional measures that are used to express the magnitude of budget deficit and debt. Specifically, Mankiw (2010, p.472-46) acknowledged four problems in the "traditional" way of measuring the deficit: The first one is related to inflation in the sense that public debt is overstated by the amount of πD where π is the inflation and D the nominal value of debt. The other ones have to do with the fact that the value of capital assets and uncounted liabilities, as well as the business cycles of the economy, are not taken into account, when the deficit is measured. However, for the needs of this study we are going to use the nominal values of the budget deficit and public debt as well as the ratio of these to the GDP.

Structurally, the budget deficit consists of the primary deficit and the interest payments. The primary deficit is the difference between the government's expenditure, except interest payments, and the government's revenue. In that sense, primary deficit represents the burden that a government creates and the interest payments are the legacy of past economic policies (Dornbusch et al., 1998, p.477). As it can be inferred, the

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relation between primary deficit and interest payments is substantial for the government's fiscal policy. The higher the debt, the higher the interest (interest payments which appear in the budget as an outlay) that should be paid each year, and consequently the less available revenue for the government.

Current Trends – Causes of Deficits

As shown Appendix A, which presents the evolution of the OECD governments' surpluses/deficits during the last 6 years and 1 in future and as mentioned in the OECD Factbook 2011-2012: Economic, Environmental and Social Statistics "there is a big variation in the shares of expenditure and revenues in the GDP across the OE CD countries and over time". In 2011 Ireland's deficit was 13% of its GDP, Estonia had 1% deficit/surplus, and Norway showed a surplus of 13.6%. In addition, there is difference in deficit/surplus over the years for all countries. For example, the rule for the US Federal Government was to run budget surpluses with the exception of wartime (Dornbusch et al., 1998). Though, now deficits became the rule in the United States. Especially, after the year 2008, when the global economic recession started, the United States experienced a situation where budget deficits increased sharply. Specifically, the deficit of the US Federal Government reached the amount of approximately $ 1.4 trillion in 2009 (Figure 4).

A similar trend, during the financial crisis the world economy has been facing since 2008, is observed in many other western economies, too. For example, according to Eurostat, the governments' budget deficits in the Euro area as a percentage of the GDP rose from 0.7% in 2007 to 6.4% in 2009 and in 2011 many of the member-countries did

not manage to achieve the 3% goal-deficit implied by the Stability and Growth Pact

(SGP). In Japan a similar substantial deficit increase took place. Nowadays, we

experience a period where the first signs of recovering from the crisis are expected,

although some countries continue to face serious fiscal problems and have severe deficits

in their budgets.

General government deficit/surplus
Percentage of GDP and million Euros
Percentage of GDP
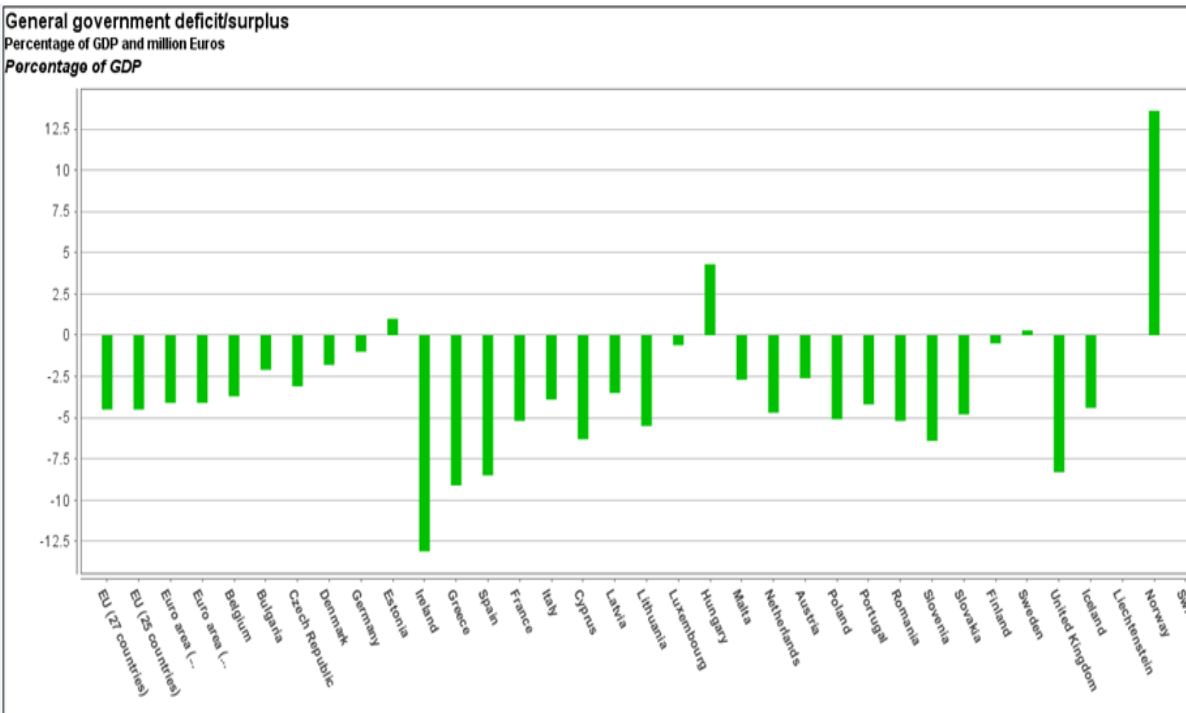
Figure 3. EU General government deficit/surplus (Percentage of GDP) 2011

The increase of deficits during the latest years is attributed to the world's

economic recession and financial crisis which especially western economies have been

experiencing since 2008: Governments, loyal to the Keynesian theory, increased

spending in their effort to revitalize the economy and avoid the "death spiral" of

recession. Moreover, several studies (Gale & Orszag, 2003; Mankiw, 2010) underscored

that the main causes of budget deficits in the U.S. are the parameter of aging population and the rising cost of healthcare. Earlier, Apostolides (1999) had argued that these two parameters (health care and public pension system financial needs) will affect deficits of the OECD member-countries, if left without attention. He also indicated that the increase of budget deficits in these countries by the fact that government expenses have been growing faster than revenues - Tanner (2011) underlined that the real budget problem of the U.S. is a spending problem rather than a revenue issue, too- and attributed this phenomenon to a number of reasons: The change of the government's role in the economy, the different attitude over the budget deficits (Keynesian theory of deficits prevailed in many cases over running balanced budgets), the increase of social spending, demographic reasons, structural unemployment - inflation and to the economic activity's slowdown that took place in many countries.
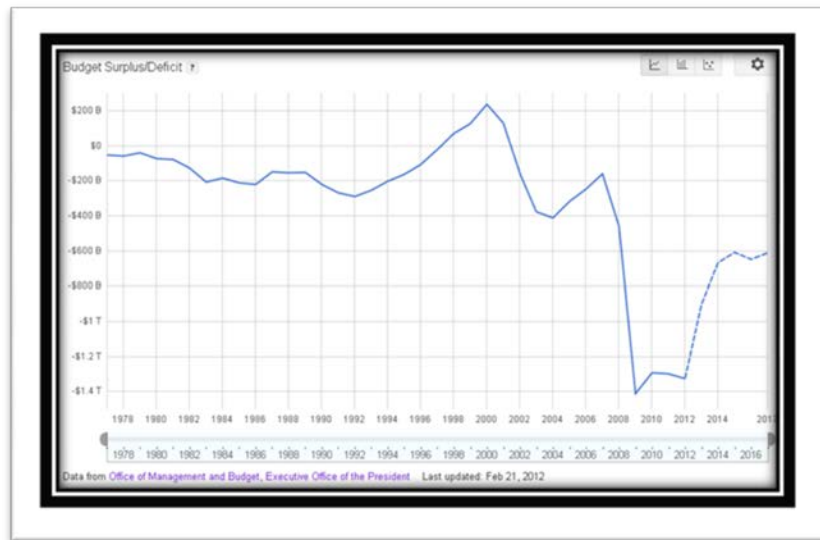
Figure 4. U.S. Budget Deficit (1978 – 2016)
Source: Office of Management and Budget, executive Office of the President (Last updated Feb 21 2012)

Government/Public/National Debt

Eurostat defines the government, national or public debt as "the sum of external obligations (debts) of the government and public sector agencies". From a different view, debt is the accumulation of past borrowing (Mankiw, 2010, p.467) and it is the "aftermath" of running budgets with deficits or as Stiglitz stated (1986, p.42), defining comprehensively the relation between budget deficit and national debt, "deficit is the additional value of the debt incurred by the government in any year". National debt is referred in the literature either as the Government Gross Debt which equals all of a government's financial liabilities, (mainly government bills and bonds) or as the Government Net Debt which is defined as the difference between the sum of all the government's liabilities and the value of all government's financial assets (OECD Glossary of Statistical Terms, 2012). Relative to its source, government debt is separated to internal and external debt. Internal debt consists of the government's liabilities to lenders within the country, and as characteristically stated by Adam Smith (1776) in this case "it is the right hand which pays the left". On the other hand, gross external debt, at any given time, is "the outstanding amount of those actual current, and not contingent, liabilities that require payment(s) of interest and/or principal by the debtor at some point(s) in the future and that are owed to nonresidents by residents of an economy (IMF, 2003)". Similarly with the case of the budget deficit, the "common" metric used for measuring one country's debt in relation with the size of its economy is the debt-income ratio for a year, which is the value of the total debt divided by the country's nominal GDP

for this year, though, Eisner and Pieper (1984) supported the opinion that official measures of debt and deficits should take into account the government's assets, either financial or not, of the period that was used as the basis of reporting the deficit/debt.

U.S. Gross Federal Debt in Trillions of U.S. Dollars
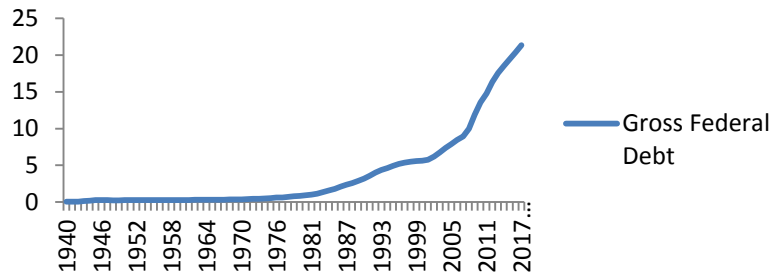
U.S. Gross Federal Debt as Percentage of GDP
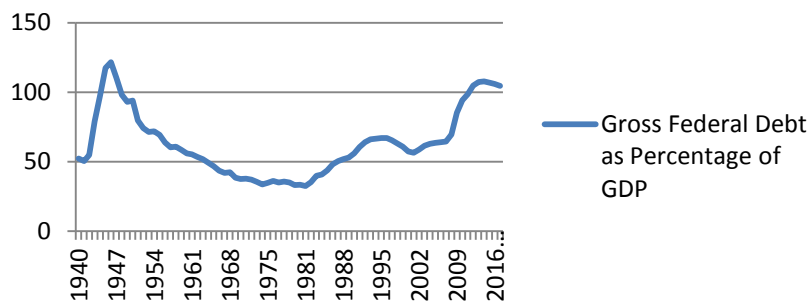
Figure 5. U.S. Gross Federal Debt and U.S. Gross Federal Debt as Percentage of the GDP (1940-2017*)

Source: The White House Office of Management and Budget

In this point, it is important to emphasize the difference between the nominal gross debt and the Debt/GDP ratio, for measuring the public debt's magnitude. Figure 5 shows the U.S. Gross Federal Debt and the U.S. Gross Federal Debt as percentage of GDP. As it can be easily implied, the behavior of the two indexes is totally different. The

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Gross Federal Debt behavior can be considered as exponential, while when graphed as a percentage of the GDP its mode is dissimilar and it shows oscillations.

The Traditional and the Ricardian View of Debt

In the literature, there are mainly two points to view on public debt in terms of its consequences to the economy: the traditional or conventional and the Ricardian view. The traditional or conventional view suggests that a deficit in the budget and consequently an increase in the public debt will lead to a "domino" of economic phenomena. According to Mankiw (2010), the traditional view implies that in the short term, government spending on consumption will be increased and this will result in the rise of output and employment, which in turn, will increase interest rates and inflation. Consequently, investment will be reduced, the value of the country's currency will strengthen and the domestic economy will lose in competitiveness. Furthermore, in the long run, although the overall effect on welfare is hard to judge, there is a general notion that the current generation would benefit at the expense of future generations, in the sense that it (the current generation) "enjoys" higher rates of employment and consumption and imposes a burden to society that has to be paid in the future.

In contrast, the Ricardian equivalence hypothesis proposed by Barro (1974 & 1989), assumes that taxpayers will not increase their consumption in the case of a tax-cut financed by an increase in debt. On the contrary, as tax-payers expect a future increase in taxes in order to pay the debt caused by the tax-cut to be offset, they increase their savings, responsively, in order to face this situation in the future (Barro, 1974). Consequently, none of the predictions made due to the traditional view will come true.

The Ricardian Equivalence Theorem has been criticized in the literature for its accuracy. For example, based on previous studies (Bernheim, 1987; Ball & Mankiw, 1995), Barth and Wells (1999) declared that "The view that deficits will have no effect on economic activity is disputed by both Keynesians and fiscal conservatives, who argue that it is based upon questionable assumptions (Bernheim, 1987). Regardless of the merit of the assumptions, substantial empirical evidence exists that fail to support the Ricardian Equivalence theorem." Similarly, other economists reject this view because they believe that the prospect of future taxes does not influence present consumption because taxpayers do not have the assumed knowledge and foresight of the government's acts and because of the borrowing constraints that people are subject to, by the banks (Mankiw, 2010). Gale and Orszag (2003), depicted the Ricardian equivalence theorem as well as the othe different views on deficits comprehensively, as Figure 5 shows.

Elmendorf and Mankiw (1999) argued in a research paper that "… the idea of Ricardinar equivalence has been extraordinary important within the academic debate over government debt". In particular, the Ricardian equivalence, although theoretically correct, is too "utopian" to be true in the real world. Despite the fact that potentially there will be individuals that will follow what the Ricardian approach implies (increase savings because they wait for a tax increase in the future), there will always be such a part of the population who will behave according to the Traditional view (increase spending for consumption), that will trigger all the forecasted economic phenomena.

DEFICIT RISES

Private saving rises by 100% of the change in the deficit		Private saving rises by less than 100% of the change in the deficit	
National saving constant Future national income constant		National saving falls Future national income falls	
No capital inflow		Change in national saving financed 100% by capital inflows	Change in national saving financed less than 100% by capital inflows
Domestic production constant		Domestic production constant	Domestic production falls
Interest rates constant		Interest rate may rise or stay constant	Interest rate rises
Exchange rate constant		Exchange rate appreciates	Exchange rate may appreciate or stay constant
Ricardian equivalence		Perfect capital mobility	Conventional view

Figure 6. Deficit Effects

Source: Economic Effects of Sustained Budget Deficits
Gale, William D; Orszag, Peter R; National Tax Journal; Sep 2003; 56, 3;
ABI/INFORM Research

Debt: Dynamic not Static

Governments do not borrow only to finance their current deficits, though an outstanding share of the funds borrowed is used in order for previous debt to be paid back to creditors in the form of principal debt or interest. So, the nature of budget deficits and the public debt is not static, but dynamic due to the interest that the governments have to pay to their creditors. Specifically, budget deficits increase government debt. Higher debt demands higher yearly payments in interest or in principal debt. Taken into account that each year's debt payments are included in the budget as an expense, there is a risk that,

under some circumstances, the continuous raise of debt will continuously decrease the funds available for the government budget revenue, until a point where the amount of money needed to satisfy debt needs will be so high that government will be unable to finance its operations with the remaining revenue and finally default. In other words, there will be a point in the future that the debt will be unsustainable, mainly due to the high demand of financial funds to repay debt, either principal or interest.

Current Situation and trends

High level of debt was traditionally considered as a usual phenomenon only in periods of depression or war time (Elmendorf and Mankiw, 1999). However, government debt has shown an increase since the 1980s, especially in the large western economies, and has evolved nowadays into an important financial-economic issue. Indicatively, the debt of the U.S. Federal Government increased from 26% of the country's GDP in 1980 to 98.3% in 2010, exceeded the "symbolic tipping point" of 100% in 2011 and it is expected to exceed the level of 108% of GDP in 2012, according to OECD Data (Appendix B). This evolution led to the first in history credit rating downgrade of the American economy by Standard and Poor's in 2011. Similarly, Eurozone in general, and especially some of the countries that participate in this economic and monetary union (EMU), experienced an unprecedented sovereign debt crisis, while Japan's debt is expected to reach the 222.6% of the country's GDP in 2013.

Considering the undesirable effects of debt on the economy and society, some States of the U.S. have passed laws that require local governments to run balanced budgets. Specifically, all states except one required a kind of budget balance (Yilin Hou,

Daniel Smith, 2006). As the debt of the Federal Government has recently increased substantially, a debate is taking place nowadays whether a same clause should be applied for Federal budget, too. Although, consensus has not been achieved yet, in the past the U.S. government voted for legislation related to budget deficits and the amount of debt (i.e. Balanced Budget and Emergency Deficit Reduction known as Gramm / Rudman / Hollings Act, 1985). The EU established the Stability and Growth Pact (SGP), which is a framework to safeguard public finances within the economic and monetary union. In its dissuasive part, SGP contains the Excessive Deficit Procedure (EDP), which is triggered when one country's deficit reaches the level of 3% of GDP. In that case, the EU provides at first the country with recommendations for how to address the problem. In case of non-compliance further action against the country is taken, including for euro-area countries the potential of imposing sanctions. Moreover, the Treaty on Stability, Coordination and Governance in the Economic and Monetary Union, which was signed on 2 March 2012 by the EU Member Countries with the exception of the United Kingdom and the Czech Republic and is expected to enter into force on 1 January 2013, implies a stricter framework concerning budgetary policy. In particular, participating member-countries agreed to run budgets, from 2013, either balanced or with surpluses.

Do Deficits and debt matter?

As aforementioned, balanced budgets was the prevailing strategy, until Keynes developed his theory according to which deficits may be desirable in periods of recession, so as to stimulate the economy (Stiglitz, 1986). Since then, there has been a plethora of research studies, newspaper articles and journal papers that address this issue. On the one hand

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there are economists who support budgets to be balanced, while on the other hand we find advocates of the opinion that deficits are beneficial for the economy under certain conditions. The debate of these two schools of economic thought seems to have started on October 1932. In particular, Keynes and five more economists (MacGregor, Pigou, Layton, Salter and Stamp) sent a letter to London Times which was published on 17 October 1932. This letter is thought to be a cornerstone to Keynesian economics, as it underscored that "the public interest in present conditions does not point towards private economy; to spend less money than we should like to do is not patriotic." (MacGregor et al., 1932). In order to support their point of view about the need of spending, the authors of the article used a characteristic example, according to which "If the citizens of a town wish to build a swimming-bath, or a library, or a museum, they will not, by refraining from doing this, promote a wider national interest. They will be "martyrs by mistake," and in their martyrdom, will be injuring other as well as themselves. Through their misdirected good will the mounting wove of unemployment will be lifted still higher." The answer came two days later by Hayek and three other professors (Gregory, Plant, Robbins), who, among others, disagreed with the Keynesian view of budget deficits. Specifically, they argued that high levels of public debt results in "frictions and obstacles to readjustment very much greater than the frictions and obstacles imposed by the existence of private debt" and answered to Keynes et al. (1932) example by stating that "… we cannot agree with the signatories of the letter that this is a time for new municipal swimming baths…". The right behavior for governments was according to Hayek et al. (1932) "… to abolish those restrictions on trade and the free movement of capital

(including restrictions on new issues) …" Another interesting approach about deficits is the one stated by the Austrian School of economic thought, according to which:

> "It is important to point out that Austrians do not argue that fiscal restraint or "austerity" will bring about economic growth (America's Great Depression, Murray Rothbard, 1963). Rather, they argue that all attempts by central governments to prop up asset prices, bail out insolvent banks, or "stimulate" the economy with deficit spending will only make the misallocations and malinvestments worse, prolonging the depression and adjustment necessary to return to stable growth[1]. Austrians argue the policy error rests in the government's (and central bank's) weakness or negligence in allowing the "false" credit-fueled boom to begin in the first place, not in having it end with fiscal and monetary 'austerity'". (Wikipedia, 2012).

It should be noted that the Austrian School of economics has gained in popularity lately, because it had predicted, in some way, the financial crisis of 2007-2008. Specifically, according to the Austrian School of economics low interest rates trigger the amplification of public debt, creating investment bubbles, which, in turn, when they burst cause a crisis. This is more or less what happened in 2007 – 2008 (Financial Times Lexicon, 2012).

Although, since this debate, there has never been agreement about the optimal deficits-debt issue among economists, the Keynesian theory started to gain approval by an increasing number of economists and policy- makers throughout the years. It is "convenient" for governments to run budgets with deficits, as they have in their disposal

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more resources to apply their policies. Though, during the last years, when the first problems started to appear due to deficits and debt, the balanced-budget approach seems to gain more and more advocates.

Adam Smith devoted a whole chapter in his book "The Wealth of Nations", which is thought to be a cornerstone in the science of Economics, discussing the topic of public debts (Book V, Chapter III). Particularly, Smith (1776) warned that the enormous accumulated public debt oppressed at that time in all the great nations of Europe could become a factor of ruining them in the long-run. He also expressed the opinion that "The more the public debts may have been accumulated, the more necessary it may have become to study to reduce them, the more dangerous, the more ruinous it may be to misapply any part of the sinking fund", which reveals his high concern about debt.

Furthermore, a powerful argument expressed by the opponents of budget deficits and public debt is that current deficits are transferred from present to future (Stiglitz, 1986; Aliabadi et al., 2011; Laffargue, 2009; Barro 1974) and some of them introduce the moral issue of how fair this shift is between generations. Specifically, Laffargue (2009) argued for governments which "finance the costs of their transfers to the living by increasing public debt recklessly", that they increase taxes paid by consumers in order to finance debt, which leads future generations to a process of "immiserisation" and emphasized the fact that "Governments make their decisions without putting weight on the welfare of future generations". Moreover, Mankiw (2010) acknowledged that in the short run, government borrowing resulted from a tax-cut would raise demand, output and employment as well as the interest rates. Consequently, investment would be reduced,

capital flow from abroad would increase and finally economy would lose in competitiveness, through a currency appreciation. In the long run, such a policy would lead to smaller capital stock and to a higher debt level. Mankiw also argued that "simply increasing the budget deficit is not feasible" and underlined the political impact of a high debt rate: First, an increase in foreign borrowing will possibly have negative political impacts as political power is related to whether a country is a debtor or creditor in the world's economy. To support this view he used Ben Friedman's words in the book "Day of Reckoning":

> World power and influence have historically accrued to creditor countries. It is not coincidental that America emerged as a world power simultaneously with our transition from a debtor nation … to a creditor supplying investment capital to the rest of the world [Friedman, 1988 - quoted in Mankiw (2010)].

Second, Mankiw argued that a high level of debt increases the potential of a default. Debt default as defined by the International Monetary Fund (2003) is the "failure to meet a debt obligation payment, either principal or interest. A payment that is overdue or in arrears is technically 'in default,' since by virtue of nonpayment the borrower has failed to abide by the terms and conditions of the debt obligation. In practice, the point at which a debt obligation is considered 'in default' will vary." As a government continues to run budgets with deficits and debt increases, credit markets become worried about the potential that the country will not be able to repay its debts in the future. The level of concern is usually depicted in the interest rate (bond yields) by which a country borrows from the investors in the world's financial markets. The norm is that "weaker" economies

or/and countries with high debt usually pay higher interest rates. As the level of debt increases, investors gradually lose their confidence that they are going to be paid back the money they lent and the interest rate increases, until the point where bonds cannot be sold to markets, due to the investors' unwillingness to buy them or until the moment that the interest rate that is required to be paid by the country is "prohibitive" for the future sustainability of its debt. It is then that the country defaults, because it fails to pay a mature debt obligation. Worth mentioning at this point that creditors' fear of a default is a "sensitive" parameter as governments/countries/sovereigns are not subject to the same sanctions that a company faces when bankrupted. Actually "There are no international statutes to deal with a sovereign debt default…" (Olivares-Caminal, 2010). In particular, when a corporation goes bankrupt, usually it is the court that intervenes in order for its assets to be liquidated and/or its management to be substituted. On the contrary, when a country defaults there are no practical sanctions to be imposed as in the case of an enterprise, because litigation is a time consuming and costly process, which can be proved as a "futile and hopeless labour" (Olivares-Caminal, 2010). However, previous experience of defaults (i.e. Argentina) shows that its consequences to the economy and society are severe. As stated by Kottlikoff and Burns (2005) in the prologue of their book "The Coming Generational Storm: What You Need to Know about America's Economic Future" [quoted in Kelton (2011)]:

> History is replete with examples of what happens when countries can't pay their bills. They raise taxes to exorbitant levels, default on their explicit or implicit obligations, and begin printing money like mad. This triggers inflation, drives

interest rates through the roof, and sends exchange rates down the tubes. Businesses go belly up, and banks shut their doors. The result is financial and economic meltdown (2004, xxiii).

So, in case of a default, the value of the domestic currency collapses, interest rates and inflation increase sharply, investors lose their confidence and avoid-refuse to lend their money to the defaulted country for a long period of time, imports become difficult and the government has no choice but to rely exclusively on the tax-revenue to implement its fiscal policy.

Other consequences of high government debt and budget deficits are the reduction in economic performance by crowding out private investment and the decrease of national income (Apostolides, 1999). Specifically, when foreign ownership of domestic bonds, real estate or equity increases there is a flow of income in the form of interest or profit abroad, which causes the reduction of the national income. Gale and Orszag (2003) attributed the decrease of national income to sustained deficits, too. In particular, they stated that deficits cause a decrease in national saving, future national income and consequently future living standards (other factors constant), no matter if the interest rates increase or not and regardless of the magnitude of the foreign capital flows. Furthermore, Elmendorf and Mankiw (1999) underscored a number of other effects of debt over the economy, including "the deadweight loss of the taxes needed to service that debt", the reduction of government's flexibility to apply its fiscal policy and the increase in vulnerability to a crisis of international confidence. Moreover, they argued that debt can affect monetary policy. For example, high debt can trigger an increase in money supply

when there is difficulty for the government to borrow in order to finance its deficits, which in turn is the "classical explanation for hyperinflation". In parallel, Stiglitz (1986) mentioned that, indeed, there is a concern about the issue that deficits result in inflation and higher interest rates. Though, it should be mentioned for the deficit-inflation relationship that Abizadeh and Yousefi, (1999) described a situation in the literature where no consensus existed among economists on this issue and stated that the empirical evidence for this subject is contradictory. In addition, Aliabadi et al. (2011) investigated the relation between first, government spending and unemployment, and second, between government spending and the Consumer Price Index (CPI) and concluded that there is no significant association among them. However, it should be stated that CPI has been calculated differently over the years (www.shadowstats.com). Lastly, Bowles (2012) acknowledged deficits of the Federal Government as the most important threat of the U.S. national security that should be faced neither entirely with raising taxes nor just with cuts; instead the solution should include an economic growth parameter, too.

The Congressional Budget Office (CBO) "warns" that debt's negative consequences are not restricted to the output area. On the contrary, rising debt would lead to higher interest payments for that debt annually, which would result in higher taxation or in a government's benefit and services reduction, or in a combination of the two. Moreover, it would reduce the policymakers' ability to face unexpected events such as a financial crisis or an economic downturn. Finally, the CBO mentions that rising debt would make a sudden fiscal crisis more possible, during which the government would not be able to borrow at rates it can afford.

On the contrary, the advocates of deficits and debt stress a number of reasons that dictate the implementation of non-balanced budgets. Generally, using the Keynesian theory as a basis for their beliefs, they argue that deficits leverage the economy and pay back the money borrowed in terms of increasing the national income (GDP). Historically, it was Keynes in his book "The General Theory of Employment, Interest and Money" (1936) that introduced the theory which implies that in recession periods during which economy suffers from low employment rates, government should increase its spending by running budgets with deficits, in order the recession to be confronted and the employment rates to raise. The debt created during recession is to be paid when the economy recovers either by increasing taxes or/and by reducing expenses.   He writes characteristically:

"If the Treasury were to fill old bottles with banknotes, bury them at suitable depths in disused coalmines which are then filled up to the surface with town rubbish, and leave it to private enterprise on well-tried principles of *laissez-faire* to dig the notes up again (the right to do so being obtained, of course, by tendering for leases of the note-bearing territory), there need be no more unemployment and, with the help of the repercussions, the real income of the community, and its capital wealth also, would probably become a good deal greater than it actually is. It would, indeed, be more sensible to build houses and the like; but if there are political and practical difficulties in the way of this, the above would be better than nothing." (Chapter 10)

He also highlighted that "…It is for this reason that a change-over from a policy of Government borrowing to the opposite policy of providing sinking funds (or *vice versa*)

is capable of causing a severe contraction (or marked expansion) of effective demand" (Chapter 8).

Likewise, Mankiw (2010, p.486) stated that deficits or surpluses may at times help the economy to stabilize. Specifically, in recession periods, government tax-revenue declines due to the decrease in economic activity. In that case, the implementation of a strict fiscal policy with balanced budgets will result in further recession, while an increase in public spending through running a deficit will revitalize the economy. Economists that support this view, declare that if governments insist to apply balanced budgets and austerity measures in recession periods, the economy will be led to a "death spiral" of continuous recession. The choice between austerity measures to balance the budget and finance growth with further deficits has evolved nowadays into a debate between economists and policy makers throughout the EU, during the sovereign crisis in the Euro-area. Other reasons, according to Mankiw, that in some cases justify deficits are the needs for "tax smoothing" and the needs to redistribute taxes among generations, namely move taxes from current to future generations. Correspondingly, Alesina and Tabellini (1990) mentioned that budget deficit and national debt serve a twofold purpose: First, they are used for "redistributing income over time and across generations" and second, "they serve as a means of minimizing the deadweight losses of taxation associated with the provision of public goods and services". Moreover, Galbraith (2010) criticized the supporters of reducing deficits declaring that a program to reduce deficits would destroy the economy, mentioning that "To cut current deficits without first rebuilding the economic engine of the private credit system is a sure path to stagnation, to

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a double-dip recession - even to a second Great Depression". He also provided arguments that for governments which keep control over their currency, the risk for nonpayment and consequently default, does not exist, and he expressed the opinion that debt is not a burden transferred to future generations and interest not a threat to the country's solvency. Kelton (2011, p.60) added to this argument that in countries like the U.S., deficits showed a temptation to cause a reduction of interest rates, favoring the view that interest rate is a "policy variable" the nominal value of which can be set by the Federal Reserve, no matter the level of deficit (p.61). Kelton also doubted about the predictions of the dominant macroeconomic models that high levels of deficits and debt will increase inflation and interest rates in the long-term, as well as cause the reduction of growth. In order to support this point, Kelton used the historical paradigms of the U.S. and U.K. economies, mentioned by Levy and Thiruvadanthi (2010), according to which although right after World War II there was a high ratio of public debt, the inflation during the following decade was kept at a low level. It was also mentioned, in this research paper, that high public debt periods have preceded high economic growth. Moreover, Kelton (2011) used the example of Japan in order to support that deficits and high debt is not a cause of higher taxes. Specifically, it was highlighted that according to data, despite Japan's high level of debt (the higher in OECD members that is expected to exceed the 226% of the GDP in 2013) taxes imposed in this country continue to be among the lowest of the developed countries. In one of the most "extreme" versions of support to deficits, some economists, known as supply-siders argue that a tax-cut and consequently a deficit can be "self-financed" in the sense that the increase in aggregate supply will be so high

that it can offset any revenue losses for the government (caused by the decrease in taxation) (Mankiw, 2010). Based on this assumption, some supply-siders believe that a deficit is not an important issue in fiscal policy and reject the hypothesis that interest rates and inflation is increased by deficits (Yousefi, 1999).

Further reference to the literature about the issue of deficits and debt goes beyond the scope of this Thesis. The main conclusion is that there is no agreement between economists about the measurement or/and the effects of the government debt or about the correct budget policy (Mankiw, 2010, p.490); there is an open debate about this issue not only between economists but among policy makers, too [i.e. disagreement between Republicans and Democrats in 2011 (U.S.) about the debt "ceiling" and among European politicians about the right strategy so as to overcome recession (austerity vs deficits to finance growth)]. Aliabadi et al. (2011) mentioned, budget deficit and public debt has been a field of research and controversies. Moreover, Alexander Hamilton mentioned that "a national debt, if it is not excessive, will be to us a national blessing", while James Madison's believed that "a public debt is a public curse".

By another view, running deficits in national budgets should be examined on a case-by-case basis according to the intertemporal budget constraint which is given by the following equation (Kelton, 2011 following Blanchard, 1990):

Equation 3. Intertemporal Budget Constraint

$$\Delta (B_t / Y_t) = (r - g) \frac{B_{t-1}}{Y_{t-1}} + \frac{(G_t - T_t)}{Y_t}$$

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where B_t / Y_t is the public debt ratio, r is the real interest rate, g denotes the output growth, G_t is the non-interest government spending, T the tax receipts, B the government's debt and Y the output. The$\frac{(G_t - T_t)}{Y_t}$ part of the equation depicts the primary deficit to output while the fraction $\frac{B_{t-1}}{Y_{t-1}}$ denotes the "heritage" of past economic policies applied. The intertemporal budget constraint shows that the ratio of the nominal debt to output (B_t / Y_t) can decline even if the primary deficit ($G_t - T_t$) is increasing in absolute value, given that the value of the output growth g is greater than the real interest rate r. Economists' disagreement about the significance of debt is based on the relation between interest rates, debt and growth. Advocates of deficits argue that growth can outpace real interest at a rate where the ratio of debt to output can be reduced, while on the other hand, "the conventional theory tends to dismiss this possibility" (Kelton, 2011, p.59). So, according to this theory, government borrowing and deficits' utility is a matter of growth. If borrowed funds are invested productively so as the rate of national income growth is stimulated and outpace the rate of interest (which may be increased by adding the (new) borrowed funds to the country's economy), then borrowing is beneficial for the country: Economy grows and the public debt ratio decreases. For example, if a government decides for a tax-cut for companies through creating a budget deficit, then this action will be beneficial only if the amount saved from taxation is invested in activities that will grow national income substantially. On the contrary, if funds are used for "counterproductive" activities (i.e. spending on imported consumer goods) then national

income will not be raised and borrowing will just result in a higher public debt ratio.

Barth, Iden amd Russek (1986) presented this point of view in detail:

> This brief discussion indicates that the disagreement over the economic consequences of federal deficits seems to hinge on whether or not the federal debt is net wealth. In this regard it has been argued that, if the rate of interest is less than the rate of growth in the economy, then federal debt is unambiguously net wealth. The reason is that in this case higher future taxes are not needed to service the debt – economic growth will be sufficient to run deficits indefinitely without exceeding the taxing capacity of the economy. If, however, the rate of interest exceeds the growth rate, then the status of federal debt is ambiguous. It will be net wealth only to the extent that current generations do not fully discount the increase in future tax liability necessary to service the debt, which in this case cannot be serviced solely with revenues generated by economic growth.
>
> … A potential problem arises, however, if one assumes that the rate of interest exceeds the growth rate. This is the problem of instability – unbounded growth of the federal debt relative to GNP. If the rate of interest exceeds the growth rate and there is a primary deficit (i.e. federal government expenditures net of interest payments exceed tax receipts), then federal debt will continually grow more rapidly than the economy. (p. 28)

Barth et al. (1986) continued their analysis by mentioning that if the situation of instability continues, government will eventually either default or monetize its deficits, which as aforementioned can be considered as an indirect default.

Within this framework, the increasing evolution of the debt/GDP ratio, experienced especially in the western economies since 1980, can be attributed to a continuing condition of instability that these economies faced. In other words, countries used funds borrowed to finance deficits "inefficiently" in the sense that income was not raised substantially enough, so as the government loans to be paid back. Therefore, debt has been accumulating and tax revenue has not followed its pace of increase. As a result, in some countries debt has risen to or close to unsustainable levels. Moreover, our perception is that the high debt level of some countries is associated with choices concerning the economic policies. In particular, the theory which supports deficits in national budgets during recession periods also implies that deficits should be paid back when the economy recovers. Data reveals that this is not what exactly happened since 1980. Even in boom economic periods budgets in western economies continued to raise their debt and deficits, somewhat unreasonably. Adam Smith (1776) in his approach mentioned about the public debt that when an event occurs in peacetime which needs to be financed by the government, it is more convenient that this expense to be financed by adding to debt (borrowing) rather by imposing new taxes that are immediately identified by tax-payers and people complain about them.

The current situation is highlighted by the debt crisis in the Euro-zone, the first, in history, US Federal Government's downgrading concerning its credit rating by Standard

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and Poor's (5 August 2011) and the International Monetary Fund's financial help to even more countries that have been unable to finance their budgets. No matter what the causes of running budgets with deficits and accumulating debts were, nowadays there are many countries which are close to or have crossed the "red line" of their debt sustainability limit and must act now in order to improve the "health" of their budgets and their national accounts. Future forecasts and trends for debt and deficits call for immediate action now. Both of these views are justified widely in recent literature by academics, policy makers and economists. Douglas W. Elmendorf, Director of the Congressional Budget Office, in response to a request from House Budget Committee Chairman Paul Ryan, highlighted the need for policy changes so as the U.S. budget deficits would be reduced. Specifically, he stated that:

> "The explosive path of federal debt that the Congressional Budget Office (CBO) projects under what many observers would view as current policies underscores the need for policy changes to put the nation on a sustainable course. The aging of the population and rising costs for health care will push spending for Social Security, Medicare, Medicaid, and other federal health care programs considerably higher as a percentage of the gross domestic product (GDP). If that rising level of spending is coupled with revenues that are held close to the average share of GDP that they have represented for the past 40 years, the resulting budget deficits will increase federal debt to unsupportable levels. To prevent that outcome, policymakers will need to increase revenues substantially relative to

GDP, decrease spending significantly from projected levels, or adopt some combination of those two approaches."

In the EU level, its member-countries, with the exception of the United Kingdom and the Czech Republic, signed the intergovernmental Treaty on Stability, Coordination and Governance in the Economic and Monetary Union, on 2 March 2012, (it is expected to enter into force in 2013) which dictates that its parties have to run national budgets in balance or in surplus. Earlier, on 7 June 2010, in Luxembourg, Eurogroup (the meeting of the finance ministers of the Eurozone) remarked in a statement that "…Ministers fully recognize the priority of halting and reversing the increase in the debt ratio and are committed to take immediate action to that effect".

Supply Chain Management

Supply Chain Definition

The term Supply Chain Management (SCM) was introduced in the early 1980's (1982) by Oliver R. Keith and Michael D. Webber in their study "Supply-Chain Management: Logistics Catches Up with Strategy" (Lambert, 2008). Since then there has been in the literature a plethora of overlapping terminology-meanings and supply chain has been a concept variously labeled in different articles and books (Croom, Romano & Giannakis, 2000). Within this framework, definitions range from Lambert's simple, though comprehensive, approach that "A supply chain is the alignment of firms that bring products or services to markets" (Lambert, Stock, Ellram, 1998) to the more complex definition given by Ganeshan and Harrison (1995), who stated that "a supply chain is a network of facilities and distribution options that performs the functions of procurement

of materials into intermediate and finished products, and the distribution of these finished products to customers". A comprehensive definition of the term is given by Stock and Boyer (2009), too, according to which, a supply chain is "a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction". Accordingly, Mentzer et al. (2001) defined supply chain is "a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer". Concerning its structure, Hugos (2003) and Mentzer et al. (2001) argued that the supply chain in its simplest form consists of the company, its suppliers and its customers (Figure 6). Both of the research papers identified three additional participants in extended supply chains (Mentzer et al. (2001) used the term ultimate), which are the supplier's supplier, the customer's customer and finally the service providers which are companies offering a variety of services such as logistics, finance, marketing and information technology.
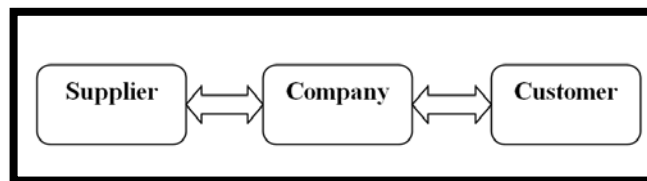
Figure 7. A simple Supply Chain (Hugos, 2003)

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Gupta et al., (2011) acknowledged three kinds of flows that take place throughout a supply chain. First, goods/services, component parts and finished goods flow downstream the SC, with the exception of returns. Second, information flows both upstream and downstream and lastly, financial funds flows upstream in a supply chain. However Coyle et al. (2011, p.20-22) agreed with the view supported by the Center of Supply Chain Research (Penn State University), stating that financials flow in a two-way manner throughout the supply chain By a cost perspective, the main difference of goods and financials in a supply chain is that holding goods and materials in the downstream flow leads to an increase of the inventory holding cost, while holding money has the exactly opposite result, as the more time a company keeps in its possession a dollar the more interest it earns (Gupta et al., 2011). In terms of the research conducted in the literature between the different kinds of flows in a supply chain, the conclusion reached is that, although there has been extensive study concerning the flow of goods (Kouvelis et al., 2006), little research has been conducted in the field of the upstream flow of money (Gupta et al, 2011).

<u>Supply Chain: a network of businesses and relationships</u>

As its concept evolved over time, a supply chain is now considered to be a network of businesses and relationships. As Lambert (2008) stated "Strictly speaking, the supply chain is not a chain of businesses, but a network of businesses and relationships." He also likened a supply chain to an uprooted tree where the root system represents the network of suppliers and the branches of the tree the customer network. Consequently,

the number of tiers in a supply chain depends on the focal company's nature. If we consider a retail company as the focal entity that sells its products only directly to end customers, there will be just one tier of customers to its supply chain. Similarly, a manufacturer's supply chain, which uses just raw materials in the production stage, will have just one tier of suppliers. On the other hand, assembly warehouses that produce for example, a special component for PCs, usually have an extended number of tiers on both sides of its supply chain. Figure 8 shows a typical supply network for a Manufacturer.

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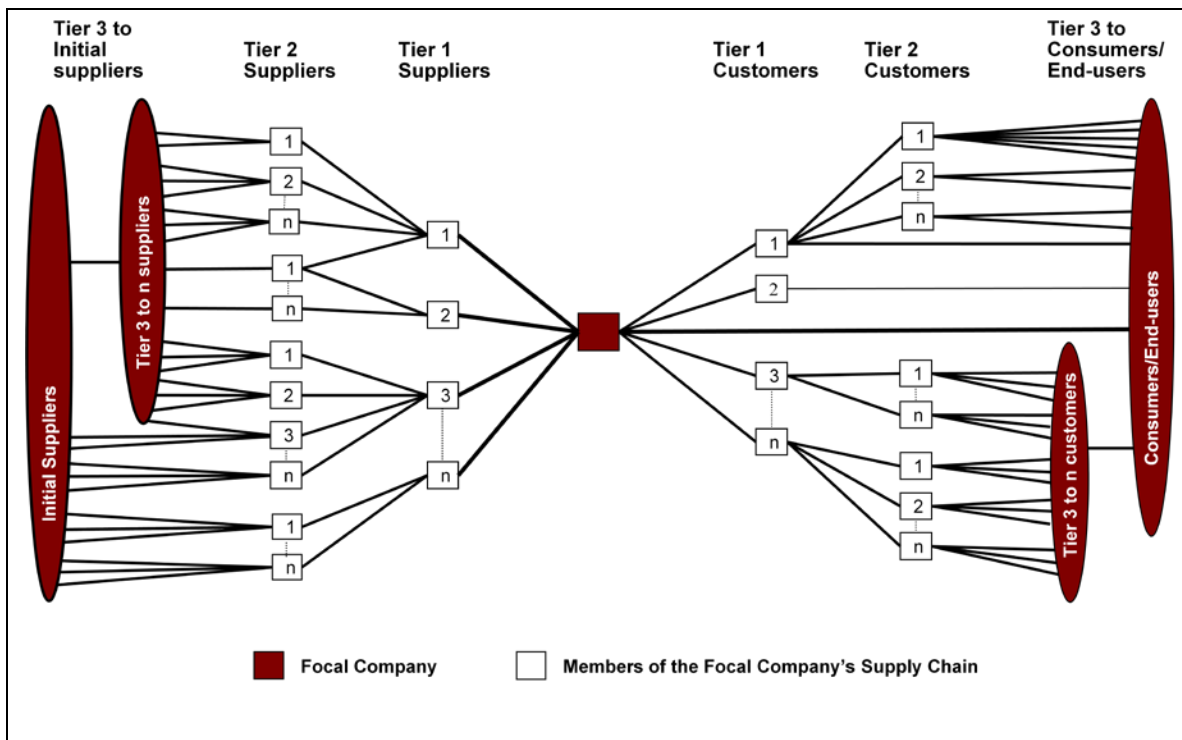
Figure 8. Supply Chain Network for a Manufacturer
Source: Supply Chain Management: Processes, Partnerships, Performance, p. 199.

Supply chain members are segmented to primary and supporting members (Lambert, 2008). Simply defined, primary are those members who carry-out value-adding activities, while supporting are the members that just provide resources, assets, utilities etc. to the primary members

Business Processes

A process is defined as "a collection of activities that takes one or more kinds of input and creates an output that is of value to the customer" (Hammer and Champy, 2003). The Global Supply Chain Forum (GSCF) acknowledges 8 management processes throughout a supply chain, which are:

1. Customer Relationship Management

2. Supplier Relationship Management

3. Customer Service Management

4. Demand Management

5. Order Fulfillment

6. Manufacturing Flow Management

7. Product Development and Commercialization

8. Returns Management

<u>Business Process Links</u>

According to Lambert (2008), supply chain members are connected with each other in each of these processes according to 4 different types of links (Figure 9). Managed Process Links are links that the focal company chooses to manage and integrate. Monitored process links are mainly links between other members of the supply

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chain that the focal company finds important to monitor how they are integrated or managed. Finally, Not-Managed Process Links are links not-managed by the focal company, while Non-Member Process Links are links between members of the focal company's supply chain and non-members of the supply chain, which, though, affect the performance of the company and its supply chain.

Mapping Supply Chains

Reasons to map a Supply Chain

Gardner and Cooper (2003) gave a set of compelling reasons to map a supply chain. Specifically, mapping a supply chain helps to link supply chain and corporate strategy. Furthermore, a map may give a signal for constraints in the whole system and may act as a basis for modifications or redesign. Moreover, a supply chain map displays the dynamics of the supply chain and offers the so-called by the authors "big picture" of it. Additionally, it provides a common understanding of the supply chain and acts as a tool for communication. Another reason to map a supply chain, according to Gardner and Cooper (2003), is that the integration progress of a supply chain can be improved. Lastly, it is stated that a map can be a means of training and can improve the management procedure of a supply chain.
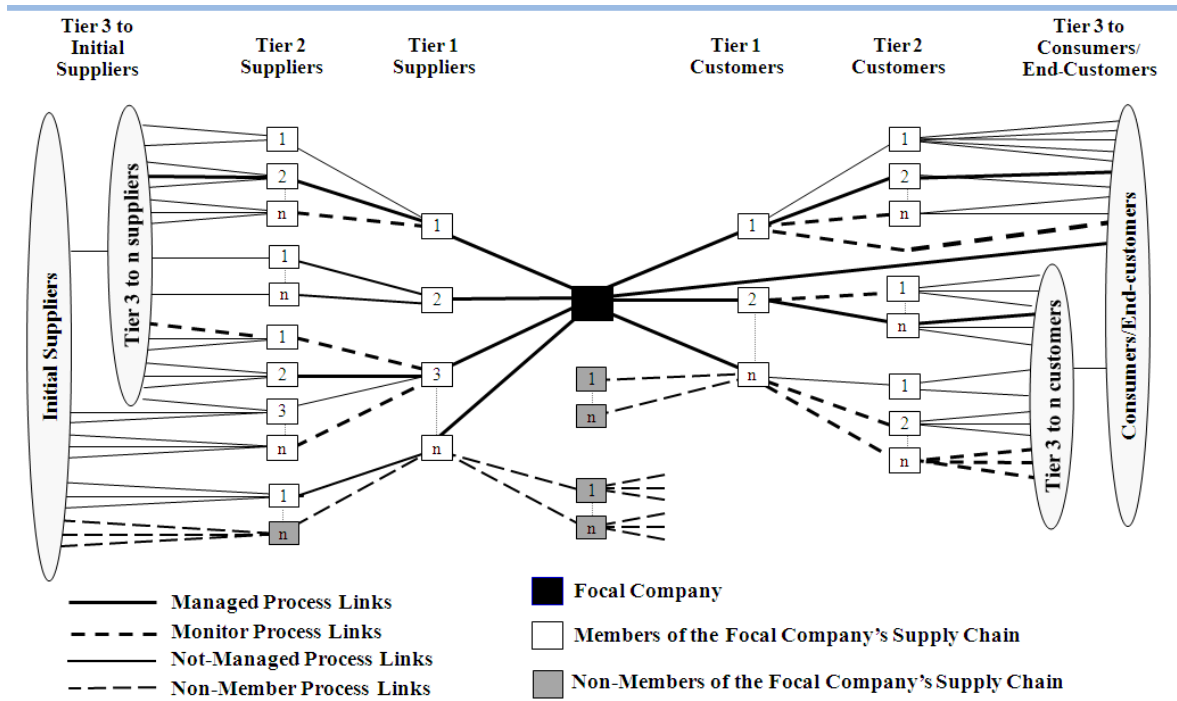
Figure 9. Types of Inter-Company Business Process Links

Source: Douglas M. Lambert, Martha C. Cooper, and Janus D. Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, **Vol. 9, No. 2, 1998, p. 7, www.ijlm.org.**

Other reasons to map a supply chain are to "determine how to better serve existing customers, to improve competitive positioning, to evaluate the potential for outsourcing, to meet the requirements of a customer segment, to improve up-stream performance and to down-stream inventory replenishment" (Lambert, 2008).

A "typical" supply chain map

Figure 8 depicts a supply chain (Lambert, Cooper and Pagh, 1998) and shows its entities and the process links between them. Worth mentioning is that the kind of link

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which connects two entities depends on the process according to which the map is generated. In other words, a supply chain may have different maps for each of the processes abovementioned, in which there will be different entities and links between them.

Systems - System Dynamics - Management Flight Simulators

Systems- Models

Supply chains are acknowledged to be systems and Sterman (2000) examined their dynamic behavior (oscillations). The word system originates from the Greek word σύστημα and is simply defined as a whole compounded of parts (Liddell and Scott, 1900) or as "a group of objects that are joined together in some regular interaction or interdependence toward the accomplishment of some purpose" (Banks et al., 2010). A more comprehensive definition is given by Sadquist (1985) according to which a system is:

> Any collection, grouping, arrangement or set of elements, objects or entities that may be material or immaterial, tangible or intangible, real or abstract to which a measureable relationship of cause and effect exists or can be rationally assigned.

A system has entities, (objects of interest), activities, states (variables that describe the system at any time, in terms of the study's goals), and events (actions that may modify the system's state), while entities have attributes, which are the entities' properties (Banks et al., 2010). Moreover a system has boundaries, which are defined as

the borders between the system and its environment. When a change occurs outside the system but affects it, we say that it happened in the system's environment (Banks et al., 2010). Law and Kelton (2000) analyzed the ways that a system can be studied (Figure 10). When physically and cost feasible, it is desirable to study a system by conducting experiments with the actual systems. However, in most cases this is not possible for a number of reasons. For instance, costs may be high, or the outcomes of the experiment may have disastrous results or the system may not even exist. Consequently, the usual case is to create a model of the system in order to make the experiments needed. In that case, models are distinguished as physical and mathematical. Although proved to be useful in some instances, physical models are not usually used. The kind of modeling typically used is the mathematical modeling, which according to the authors represents a system in terms of logical and quantitative relationships, which are then changed, in order to see how the whole system will react. For simple mathematical models, it may be possible to get answers to the questions raised by working on the system's relationships, and get analytical solutions. On the contrary, in complex systems analytical solutions cannot be obtained with simple mathematical modeling and simulation is the only way to study a system.
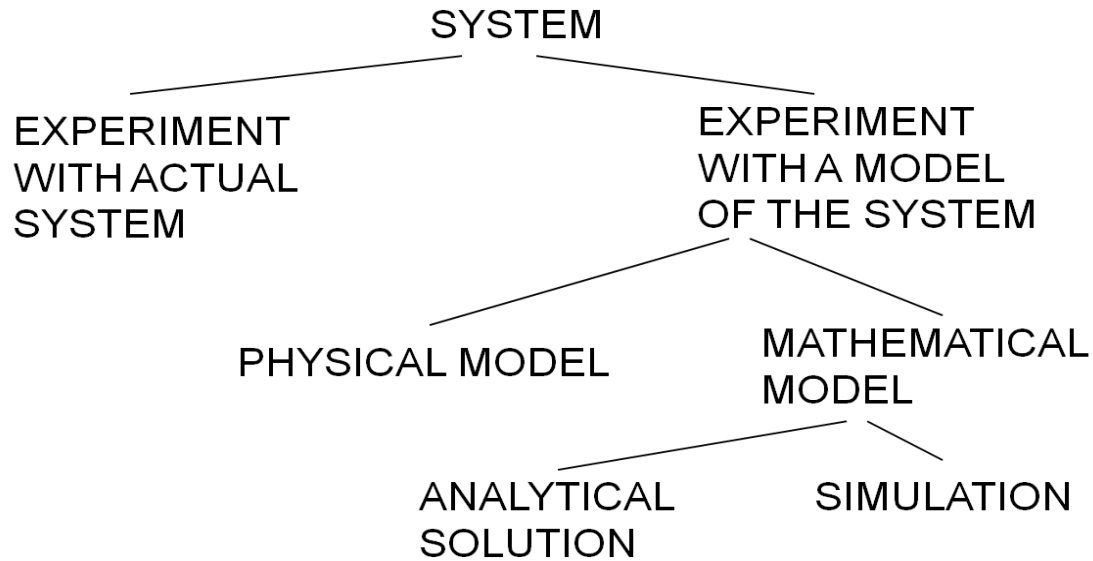
Figure 10. Ways to study a system
Source: AM Law, WD Kelton, "Simulation Modeling and Analysis", McGraw Hill

Series in Industrial Engineering and Management Science, 2000

Policy Resistance – Systems Complexity

Our world is dominated by systems of different types and different natures (social, economic etc.). Various types of problems arise in systems and action is required so as to mitigate or even eliminate their negative effects to the system's entities or to external subjects and objects. For example, excess deficit is a problem for the budget system. If the government attempts to reduce the deficit by cutting spending, this may result in a fall in tax revenue that can outpace the reduction in outlays and finally lead to an increase of deficit, which actually is the opposite of what was anticipated. Sterman (2000 & 2001) who has made an extensive analysis of systems dynamic modeling, named such phenomena, namely "the tendency for interventions to be defeated by the response of the

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system to the intervention itself", as policy resistance. Policy resistance is caused mainly by the systems' complexity and especially by the dynamic complexity which is defined as a state of "counterintuitive behavior of complex systems that arises from the interactions of the agents over time" (Sterman, 2001). Dynamic complexity arises, in turn, because systems are constantly changing, tightly coupled, governed by feedback, nonlinear, history dependent, self-organizing, adaptive, counterintuitive, policy resistant and are characterized by trade-offs. (Sterman, 2001).

<u>System Dynamics</u>

The solution to the problem of policy resistance, according to Sterman (2001) is systems thinking. Systems thinking is the skill to see the world as a system that is complex and requires the acceptance of two assumptions: First, that "you can't do just one thing" and second that "everything is connected to everything else".

Systems thinking operates as a basis for system dynamics (Toole & Hufford, 2004). According to the System Dynamic Society, system dynamics is an approach to analyze and design policy in dynamic problems and it was introduced by Prof. Jay W. Forester, at Massachusetts Institute of Technology (MIT), in his book "Industrial Dynamics" (1961), which is thought to be a cornerstone in this field of science. Although, system dynamics was first introduced by Forrester for the industrial sector, nowadays it is used for many other kinds of systems and as Sterman (2000) stated, it has been applied to a wide range of issues, including corporate strategy and public policy; it has even been used in the arms race case between the U.S. and the USSR during the cold war. Generally, system dynamics is used for systems that change over time i.e. to

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www.manaraa.com

socioeconomic systems (Größler, Thun & Milling, 2008; Sterman, 2000) and for any dynamic system with spatial scale (Sterman, 2000). Moreover, it has been used as a helping tool for management teams, in order to formulate strategy and to improve learning (individual, team and organizational) (Warren and Langley, 1999).

As defined by Sterman (2001), system dynamics refers to a "method for developing management flight simulators (often based on formal mathematical models and computer simulations) to help us learn about dynamic complexity, understand the sources of policy resistance, and design more effective policies". It is based on the hypothesis that feedback loops, accumulation processes, and delays between cause and effects are characteristics of the social systems' structure (Größler et al., 2008) and on the statement that "technical tools and mathematical models" are not adequate for successful interventions in complex systems (Sterman, 2000). System dynamics has gained in popularity due to its unique ability to represent the real world, as it can embody the complexity, nonlinearity and feedback loops that are present to social and physical systems (Forrester, 1994).

Sterman (2001) also identified the tools that, in his view, can be used in order to gain knowledge of complex systems: casual mapping and simulation modeling. However, he underscored that in complex systems characterized by numerous loops accompanied with time delays, nonlinearities etc., causal mapping becomes an insufficient tool and stated that simulation in such cases is an essential choice. Accordingly, Größler et al., (2008), based on Forrester's research (1994) mentioned that "a model-based analysis is not complete without simulation", while Maier & Strohhercker, (1996) stated that

simulation is essential for learning and understanding complex systems, as well as that, analysis of problems, mapping of structural elements and modeling without to simulate is not sufficient.

Simulation modeling - Management Flight Simulators

Models

The "products" when applying dynamics theory and method in order to analyze social systems are models (Größler et al., 2008). According to Banks (2010) a model is "a representation of a system for the purpose of studying that system", i.e. when there is a need to understand the relationships that exist between the system's components and/or a forecast of how a system will react in a new policy. Similarly, Forester (1961) defined models as substitutes for systems and found them important because they are more effective in transferring the behavior characteristics than the observation of the real system does and because they offer information less costly.

Simulation - Management Flight Simulators

Simulation is defined as "the imitation of the operation of a real-world process or system over time". It is used either for designing new systems in order to specify their behavior under different conditions and/or for forecasting changes in existing systems, if we impose at least one change (Banks et al., 2010) and it is the characteristic that distinguishes system dynamics from the other forms of systems thinking (Größler et al., 2008).

A special case of simulation, used in system dynamics, is Management Flight Simulators (MFS), which initially were named as Microworlds. A Management Flight

Simulator (MFS) is "a learning tool that allows managers to compress time and space, experiment with various strategies, and learn from making rounds of simulated decisions. … and can be used in situations where real life experimentation is unfeasible because of cost considerations, time involvement, or both" (Bakken, Gould and Kim, 1992). MFSs can have different forms such as physical models, board games and computer simulations (Sterman, 2001). As implied by their name, they are based on the philosophy of the real flight simulators. Like aircraft pilots, who use simulators for training in a virtual environment, MFSs players manage virtual organizations.

MFSs are not a method of forecasting the future. Rather, they are virtual worlds that give managers the opportunity to develop decision-making skills, to conduct experiments or just to play (Sterman, 2001). For Toole and Hufford (2004), MFSs teach principles of systems thinking, "… using simulation contexts that students could understand without having advanced knowledge of a specific industry or underlying technologies". In general, management games, either MFSs or Corporate Planning Games, have an important role as training and teaching tools (Milling, 1997) or as Bakken et al. (1992) placed it, "a MFS can help in sorting out competing explanations by allowing participants to conduct experiments and learn from them". Cost is another advantage of using MFSs, mentioned, directly or indirectly, by a number of researchers (Bakken et al., 1992; Saunders, 2012; Maier & Strohhrcker, 1996). Moreover, like in the case of real flight simulators, the MFSs' virtual environment allows managers to replicate situations of extreme conditions, without exposing real systems to any danger; managers

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can conduct their experiments in environments that failures are allowed and they do not have to face the consequences of the real world (Maier & Strohhrcker, 1996).

Despite the advantages abovementioned, research in the literature conducted by Sapiri et al. (2012) showed poor development of MFSs, in several areas, for decision making. The lack of MFSs' extensive use is justified by the fact that most of them are "either too simplistic to feel "real" or too complex to learn from" (Bakken et al. (1992).

The Beer Game

Introduction to the Beer Game

The Beer Distribution Game or Beer Game is a Management Flight Simulator and it was developed at the MIT Sloan School of Management in the 1960s (Jacobs, 2000), so as to introduce the management students to the concepts of computer simulation and economic dynamics. Since after, it has been played internationally by a wide range of people, including students, chief executive officers and government officials (Sterman, 1989). From a supply chain view, the game intends "to understand the distribution side dynamics of a multi-echelon supply chain used to distribute a single item, in this case, cases of beer" (Wikipedia, 2012). Strozzi, Bosch and Zaldivar (2007) mentioned that the Beer Game has been broadly used in schools of management, in order to show students the causal relationship between the decisions made by managers and the supply chain's reaction to these decisions and stated that the game illustrates "how oscillations can arise in economic and managerial systems" and how simulation models can be used in order to

"fit different order policies". Moreover, Reyes (2007) acknowledged that one of the game's goal is the understanding of the obstacles to effective supply chain management.

Rules

The game in its manual version is played on a board (Figure 10), which depicts a system of beer production and distribution. The whole system consists of four entities: Retailer, Wholesaler, Distributor, and Factory (R, W, D, and F). It is played by four or more people. Players are assigned into teams of four or more people and each team forms a production-distribution system with four entities. Each entity (R, W, D, and F) is usually managed by one or two players. Cases of beer are represented by pennies and customer demand derives from a deck of cards. The unit of time used in the game is one week.

In this linear production - distribution system, there is a flow of information (orders) and an opposite flow of products (cases of beer). For each week, the retailer satisfies the customer demand from its inventory and makes an order to the wholesaler, who ships the beer requested by its own inventory. The same procedure takes place upstream on the board, between the subsequent entities of the supply chain (the wholesaler orders and receives beer from the distributor, who in turn orders and receives its beer from the factory, which produces the beer). Beer orders are not received right after they are made. On the contrary, there are delays between each sector, which in the classic version of the game is two weeks between echelons. The goal of each player is to minimize cost, given that the inventory cost per case of beer per week is $0.50 and the stockout cost (backlog) per case of beer per week is $1.00. In other words, players must

keep the lowest possible inventory and at the same time avoid backlogs. The "winner" of the game is the team or the player (when only one team exists) that will have the lower cost.

The production-distribution system is based on a number of assumptions. First, there is no capacity constraint for the factory that produces the beer; the factory produces the order given by the distributor, no matter its volume. Moreover, it is assumed that order cancels and returns are not allowed.

During the game, information constraints apply. Specifically, players of different stages are not allowed to communicate freely and information flow is restricted just to shipments and orders between adjacent subjects. Moreover, each week's customer demand derived from the pack of cards is not communicated to all players, but the retailer is the only level to know final demand. The only demand known by other entities (wholesaler, distributor and factory) is the demand of their customer, by the orders received. These restrictions eliminate the possibilities of synchronization and common strategy, between the players that manage the different entities in the beer supply chain. However, the entities of each chain keeps detailed records about the orders placed, the orders received, their inventory level and the potential backlogs for each week.

The game is in equilibrium at first. Each entity has 12 cases in its inventory and each delay phase contains four cases. Initially and for the first 4 usually weeks the demand is constant at 4 cases and players are directed to keep the equilibrium by ordering 4 cases, in order to get acquainted with the game's processes. After this familiarity period, players are informed that demand is going to be unstable from that point on and

the game literally begins. Now each entity of the chain may order the quantity it wishes.

From this point on, the demand is set at 8 cases per week until the end of the game.

Simulation of the whole process is considered to run for a maximum of 50 weeks, but it is

actually stopped around the 36^{th} week, in order to avoid "horizon effects".
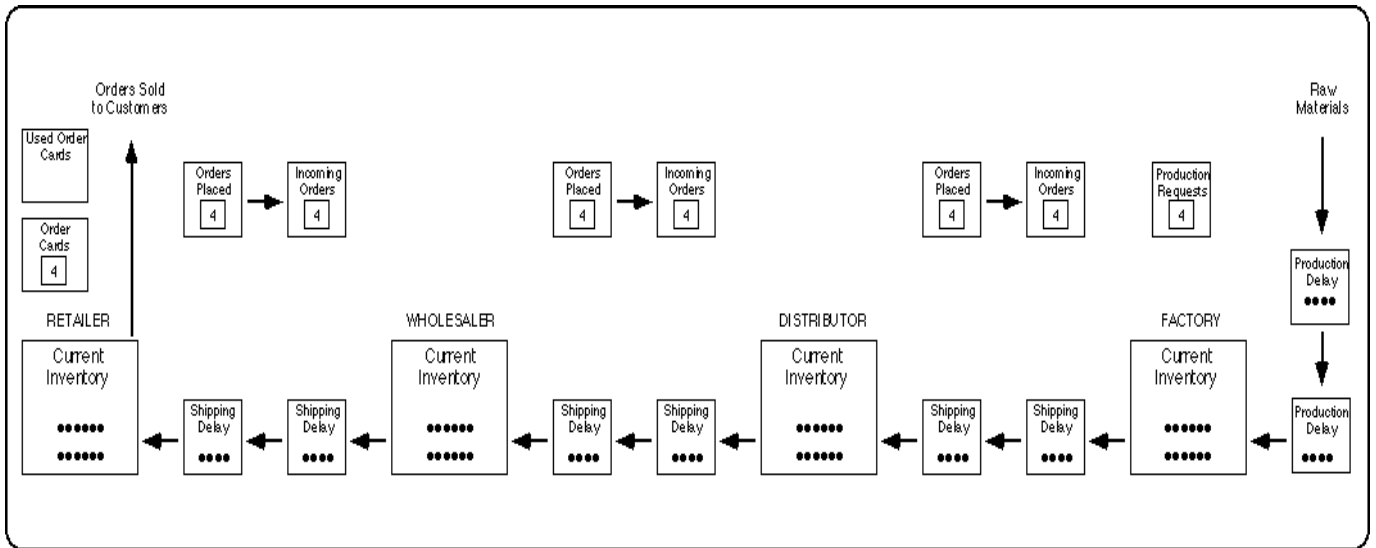
Figure 11. Beer Distribution Game Board
Source: Sterman, J. D. (1989). "Modeling Managerial Behavior: Misperceptions of Feedback in a Dynamic Decisionmaking Experiment",.Management Science, 35(3), 321-339.

Results

Sterman (1989) analyzed econometrically some of the game results, approached

the players about their behavior during the game and finally presented some important

and interesting outcomes. He first took a "representative" sample of actual trials of the

game. He, then, simulated the process and he determined the minimum total costs that

could be obtained by "optimal" decision making. Afterwards, he compared the

benchmark costs created by simulation, with the actual costs taken by the eleven real

trials of the game (44 subjects) and concluded that the actual average team costs exceeded the benchmark costs by ten times and that similar results are obtained when the individual sectors are compared with each other. The results he presented were highly significant. Additionally, he found three basic similarities in the behavior of the subjects. The first similarity mentioned is oscillation, which is translated in large fluctuations of orders and inventory levels. The second similarity is, according to Sterman, the amplification in orders, which is known as the bullwhip effect and finally, the third is the phase lag, namely the later occurrence of peak order rates, as we move from retailers to factory. Sterman, according to Jacobs (2000), also concluded that:

> … an anchoring and adjustment heuristic for stock management was a good fit to the behavior" …players fall victim to several "misperceptions of feedback" … the players failed to account for control actions, which had been initiated but have not yet had their effect (i.e. they were looking at inventory on-hand rather than the inventory in position). In Sterman's studies the majority of players attributed the dynamics they experienced to external events, when in fact these dynamics were internally generated by their own actions.

Value - Lessons Learned from the Beer Game

The fact that the Beer Distribution Game has been played for over almost four decades in universities, companies and governmental agencies reveals its value. Specifically, as a competition game between teams, it serves several educational purposes: cooperation between teammates, competence between teams and discipline to the rules are only some of them. However, without underestimating its value as an

educational tool, the Beer Game teaches players some fundamental postulates of the Management science, too. Some of them are presented on the webpage of the MIT Sloan School of Management. Specifically, according to Sterman, at the end of the game players realize that it was their decisions that created the instability in the whole system and not an exogenous factor, like the instability in customer demand. Moreover, the game operates as a proof that "Most people do not account well for the impact of their own decisions on their teammates – on the system as a whole" and they "…forget that they are part of a larger organization".

III. Conceptual Model: Mapping a National Budget as a Supply Chain

Introduction

Considering Lambert (2008), who stated that mapping is the first critical step to understand a supply chain and following Größler et al. (2008), who asserted that system dynamics projects usually consists of the conceptualization/modeling phase and the simulation/experiments phase, we present in this chapter the first part of the initial phase of the project: the conceptual model - map, that depicts the national budget as a supply chain, where the focal company is considered to be the government. The proposed map is based on the Government Budget Constraint (GBC) equation and on the fundamentals of mapping a supply chain (Cooper and Gardner, 2003 & 2005; Lambert 2008).

Mapping a National Budget as a Supply Chain

National budgets can be considered as a special case of a supply chain. Following the Mentzer's et al. (2001) broad definition of supply chains, a national budget is a set of entities (organizations or/and individuals), directly involved in the upstream and downstream flow of products (public goods), services (public services), finances (taxes etc.), and/or information (tax policy guidelines) from a source to a customer.

The national budget is mapped as a relationship-based supply chain (Figure 12) from a demand management process view, in the sense that a budget, by definition, is a balancing supply-demand process of financial funds and it is the demand management process in a supply chain that "balances the customer's requirements with the capabilities of the supply chain" (Lambert, 2008).

Within this framework, the following map (Figure 12) was created that illustrates the national budget as a supply chain.

Supply Chain Tiers - Entities

The conceptual model presented in Figure 12 comprises three tiers. In particular, the focal entity in the supply chain is considered to be the government, which is presented in a two-level mode. The first level consists of the entity which is responsible for applying the government's fiscal policy (Ministry of Finance or the Department of the Treasury), namely form, implement and audit the national budget. The second level includes the government's organizations (Ministries, Departments etc.) that are financed with budgetary funds, in order to apply the government's policies in education, health, defense, etc. By another view, the entities that belong to the second level could form the first tier of customers in the supply chain presented, as in some way the Ministry of Finance or the Department of Treasury is the supplier of their funds. Though, it was preferred to consider government entities as a whole and regard the later entities as internal customers, rather than place them in a separate tier.

Tier 1 customers contains the recipients of public spending in the form of public goods and services (individuals and companies), as well as the investors that earn interest from the bonds they hold. For simplicity reasons, customers were segmented into two major categories, as their number is large (usually there are millions of taxpayers and investors). Though, customers can be and should be segmented in to more categories. For instance, taxpayers can be separated in individuals and companies, or a creditor that
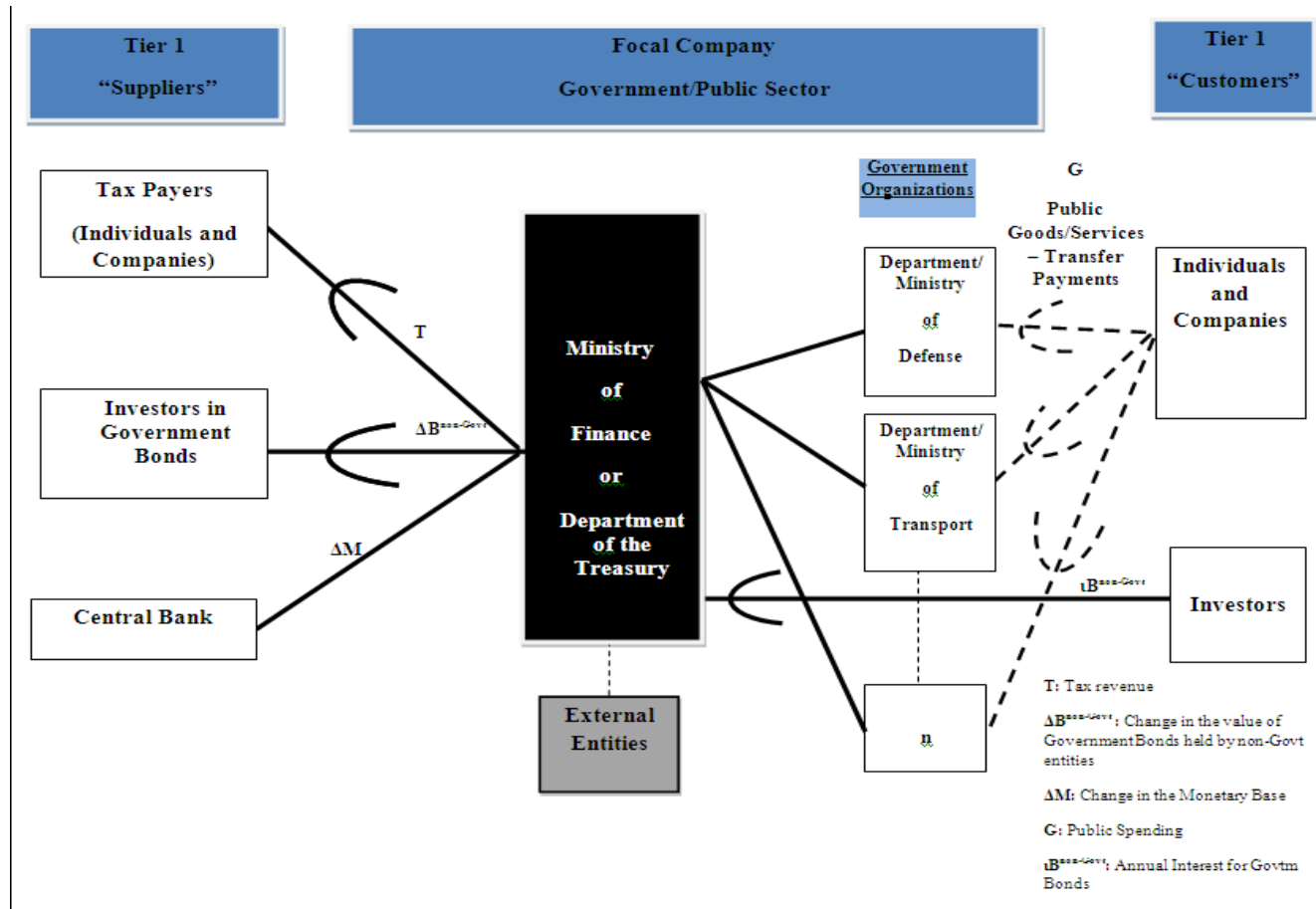
Figure 12. Mapping National Budget as a Supply Chain

keeps a significant amount of the country's debt can be mapped separately and not be included in the investors' entity. Generally, like in the supply chain case, the criteria for ranking, and segmenting suppliers and customers for the needs of a supply chain map should be examined on a case-to-case basis.

Tier 1 suppliers are segmented into the tax payers of the country (individuals and companies), the investors who buy government bonds and the country's central bank and they consist actually of the government's sources of budgetary revenue. Tier 1 suppliers are segmented in three general categories for simplicity, but this segmentation should be examined carefully on a case-by-case basis, too. Theoretically, it appears that in this supply chain, the customers are the same with its suppliers. Consequently, the question that arises is why and how rational is in a supply chain to have customers that at the same times belong to its suppliers. First, the sets of taxpayers (individual and companies) in the two sides of the supply chain are not identical. For example there are companies that for some reason are exempted for any form of taxation although they are recipients of public goods and services; or there are investors that have bought government bonds during year t, but they are not going to be paid interest annually, which means that for the years they will not receive an interest payment, they are not going to be included in the supply chain as customers. Though, it is a fact that the most part of suppliers and customers overlaps. Although this characteristic makes budget a special case of a supply chain, it should be mentioned that an entity, i.e. an individual taxpayer, does not behave the same as a taxable subject and as a recipient of public goods. Moreover, as the number of the taxpayers that comprise each category of suppliers and customers are large (millions of

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taxpayers), two entities with the same characteristics in the tier of suppliers may belong to different groups in the customer tier. For instance, two individuals may have the exact same taxable income, but receive totally different levels of public goods and services. Another interesting feature is that investors as suppliers and customers are unknown (nobody is sure about the identity of the individuals or companies that hold government bonds, and the value of the bonds that each of them has in his/her disposal). Although, this is what happens in the case of customers in a typical supply chain (customers are rarely known individually), suppliers of tier 1, whom identity is not known and cannot be found, is something unique for a supply chain.

Furthermore, there are external factors and entities, which despite the fact that they do not belong to the supply chain, they affect it in many ways and that is why they are included in the map. Such an entity is for example the economy of another country, which despite the fact that it is not a member of the supply chain, it can affect it under specific conditions.
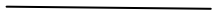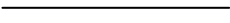
Lastly, it is important to distinguish the primary from the supporting members of this supply chain. Tax payers, namely the individuals and companies that are taxed and receive public goods and services, either as suppliers or as customers, the Ministry of Finance or the Department of the Treasury (generally the organization(s) that is/are responsible to form and apply the budget), and its internal customers (agencies that receive budget funds) are the primary members of the budget supply chain, as they carry out value adding activities. On the contrary, investors or/and the central bank, who

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participate in the supply chain by just providing financial resources are usually considered to be supporting members.

Links

For the needs of this study, the icons used by Gardner and Cooper (2003) and Lambert (2008) were adopted, in order to link the entities in a supply chain (Table 3). It is logical for the organization(s), which is/are responsible for the national budget, like every focal company, to make efforts for managed process links with at least the first tier of both suppliers and customers. In that sense, the relationship between the organization(s) mentioned above and the tax payers, the investors who buy bonds issued by it and the central bank can be considered as managed process links. The management and the integration between the aforementioned organization(s) and the taxpayers are mostly determined by the tax policy implied, while the relationship with the investors is quantified and assessed by the interest rate that the later charge for borrowing their money. The relationship of the central bank with the organization(s) responsible for the budget is determined by the level of authority that government has on the central bank and it is different in each country. Moreover, the focal entity of this supply chain is linked to the government organizations/agencies that are financed by the budget with managed process links. It is clear that the organization(s) responsible for the budget transfers funds to these organization/agencies in order for them to implement their programs, with the obligation to account for where the funds were spent. The relationship between the organizations/agencies that are financed by the government and the taxpayers (as customers) are monitored by the focal entity relationship. The Ministry of Finance or the

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Department of the Treasury monitors whether the budgetary funds were spent for the reasons they were given. In addition, the focal entity in this supply chain is connected with a managed process link with the investors (as customers).

Icon	Meaning
	Link between SC members:
	One of many
	Single source with many substitutes
	Managed Process Links
	Monitored Process Links
	Not-managed Process Links
	Non-member Process Links
■	Focal Entity
☐	Members of the Focal Company's Supply Chain
▨	Non-members of the focal Company's Supply Chain

Table 1. Icons for Supply Chain Mapping
Sources: Lambert (2008), and Cooper and Gardner (2005)

Lastly, as in most cases, non-members of the supply chain are connected with a non-member process link with the focal company.

Theoretical Justification of the Model

The rationale of parallelizing national budgets to supply chains is based on the following arguments. First, as aforementioned, using Mentzer's et al. (2001) supply chain

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definition ("a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer") a national budget is consistent with all the description and the characteristics of a supply chain. As shown in the analysis conducted above, financial and products/services flows exist in the conceptual model and there are numerous entities involved in this upstream and downstream flow of information, financial funds and product-services. The source is the entities that provide the funds to the government to run the budget and the customers are the individuals and firms that are located in the country's territory as well as the investors that hold bonds. While the term "supplier literally fits" in every case used in the conceptual model, the concept "customers" may raise some questions: how can the citizens living in a country and the companies stationed in its territory be characterized as the government's "customers? The answer lies in the definition of the word customer: A customer is "the recipient of a good, service, product, or idea, obtained from a seller, vendor, or supplier for a monetary or other valuable consideration"(Wikipedia, 2012). Within this framework, the citizens, the companies and the investors, who have in their disposal government bonds, can be considered as the government's customers, as they receive the utility of the (public) goods and services produced by the government, for a valuable consideration; citizens and companies pay taxes, while investors buy bonds and receive profits (interest).

Moreover, conceptually, relationship-based supply chain maps and budgets are similar, in the sense that they both aim to allocate resources within a network of organizations and their focus is the relationship between the entities they are comprised.

Practical Utility of the Model

Mapping - modeling a national budget as a supply chain can be beneficial in various ways. First, based on Gardner and Cooper (2003), such a map helps to link the whole supply chain (budget policy) with the fiscal policy. Moreover, a map may give a signal for constraints in the whole system, i.e. as flows become apparent a supply chain based map of a national budget reveals the actual government's deficit and the magnitude of debt, which can determine the limit of government's borrowing capability. It can also identify important entities for the supply chain's operations, such as a group of taxpayers that contributes substantially in the tax revenue gathered. Furthermore, it may act as a basis for modifications or redesign of the government's fiscal policy and it gives the "big picture" of the national budget by transforming a mathematical equation into a comprehensive figure, much friendlier to the reader. Additionally, it provides a common understanding for the budget by visualizing the budget relationships and can act as a tool for communication. Furthermore, such a map can be a means of training for policy makers and can improve the budget's management. Lastly, if the flows of goods/services offered by the government to public (individuals and companies) are reported-mapped in detail, the national budget supply chain map may be used as a basis for evaluating the potential of outsourcing. Lastly, the potential of implementing supply chain techniques in

national budgets, with the intention of saving resources is a challenging approach of the proposed conceptual model.

IV. Modeling and Exploring the Dynamics of the Budget Supply Chain as a System

Budget as a System

In this part of the thesis, research is focused on modeling the budget as a system (Figure 13). Using as a basis the supply chain map introduced in the previous chapter and taking into account the meaning and the definition of the term "system" already presented in Chapter II, national budgets can be considered as systems with the following components and characteristics:

Entities

The system's entities consist of the tax payers (companies and individuals), the government organization(s) responsible for forming and implementing the budget (mainly the Ministry of Finance or the Department of the Treasury), the government organizations that are recipients of budget funds and finally the investors, who obtain government bonds.

Attributes

Each entity has various attributes. A good example of an entity's attribute is the taxable income of a taxpayer.

Activity

Imposing taxes, buying bonds in the credit markets and paying taxes are typical activities of the government agency(ies) responsible for forming and implementing the budget, the investors and the taxpayers, respectively.

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Events

An event in the system may, for example, be a change in the interest rates (exogenous event) or the application of a new tax (endogenous event).

State of the system

It is defined in any particular moment by a set of variables, such as the amount of government deposits, number of taxpayers, amount of bonds sold, etc.

Flows

Considering the system's components, as well as the map of the budget as a supply chain, a model that presents the flows throughout the budget system is introduced, using Forrester's (1961) notation and symbols, (Table 5). In this model, the flows between the focal entity (government) and the Tier 1 suppliers are financial (flows) and represent the left part of the Government Budget Constraint (GBC), which is denoted by the equation:

$$\text{T} + \Delta B^{Non-Govt} + \Delta \text{M} = G + iB^{Non-Govt}$$

Specifically, the financial flows from taxpayers to the government is the tax-revenue (T), the flows between the investors in bonds and the government is the change in the value of government bonds bought by non-government entities ($\Delta \text{B}^{non\text{-}Govt}$) and the flow from the central bank represents the change in the monetary base (ΔM). The first two flows represent fiscal policy tools, while the last one stands for the monetary policy applied. The special feature of the financial flow between the taxpayers and the

government is its compulsory character; taxpayers are obliged to pay the taxes determined. They are either direct payments (income taxes, property taxes etc.) or indirect, such as in the case of the indirect taxes, [Value Added Tax (V.A.T), fuel tax etc.].

The flows between the entity in charge of applying the government's policy (Department of Treasury or Ministry of Finance) and the other government organizations are internal and financial, in nature. Actually, they include the budget financial transfers from the former to the later, in order for the government policies and programs to be implemented. Subsequently, the flows from government agencies to individuals include the supply of the public goods-services. The total cost of the public goods-services offered from government organizations, plus the transfer payments compose the total government spending (G).
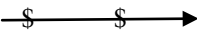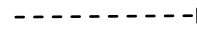
Moreover, financial funds flow directly from the Department of Treasury or the Ministry of Finance to investors that have government bonds in their disposal, in the form of interest payments. In total, this flow represents the annual cost of government's borrowing (annual interest payments) and represents the value of $iB^{non-Govt}$ in the Government Budget Constraint.

Worth mentioning is that between the system's entities there is a two-way flow of information (downstream and upstream). For instance, there is an upstream flow of information between the government agencies financed by the budget and the organization responsible for the formation of it annually, in the preparation stage; the former send their anticipated needs for the next fiscal year to the later. Another example

is the information flow that takes place between the government and the public in general; the economic and budget policy is decided by the government, approved by the appropriate legislative body (the Parliament or the Congress) and transferred to the public by several means, such as by the Official Newspaper of the Government, by laws or even by the media. Moreover, the government organizations responsible for the implementation of the budget publish on a regular basis financial information and extended budget data, concerning the GDP, the budget deficits, the public debt etc., so as to communicate the situation of the public economics. Within this framework, usually one year after the end of each fiscal year (i.e. 1-1-2012 for the fiscal year 2010), the budget's final balance sheet is given to the public, which contains detailed information about the actual revenue gathered, the total amount of the outlays, the budget's deficits or surpluses etc. The comparison of the data on the balance sheet, with the information on the budget for each year, determines how successful the implementation of what was scheduled in the budget was. In addition, there is a continuous communication channel among the organization responsible for the budget implementation and the agencies financed by the budget, throughout the fiscal year, where useful information concerning the budget and fiscal policy flows. Lastly, the information flow, among the organization(s) responsible for the formation and execution of the budget and the tax payers, literally constitutes the tax policy applied.

An interesting characteristic of the supply chain modeled is the direction of flows. In typical supply chains there is a downstream flow of goods/services (except for returns) and a reverse flow of financial funds. In this case, there is a financial flow of funds

downstream, with the exception of the flows between government and the last tier of customers, where financial funds are also partially transformed to public goods and services. Lastly, the exogenous variables that affect the budget are separately depicted in the model.

Symbol	Meaning
⟶	Flows of Goods and Services
$\$ \quad \$ \longrightarrow$	Flows of Financial Funds
- - - - - →	Flows of Information
⧖	Decision Function (Determine the Rate of Flow)
Table 2. Symbols for Flow Diagrams **Source: Forrester (1961), "Industrial Dynamics". P.82-83**	

Classification of the Budget Model - System

The model described above is descriptive according to Ragsdale's (2008) definition, given that the relationship between the variables is well defined by the GBC equation, but there is uncertainty about the exact values of the independent variables (we consider as independent variables the tax revenue T, the non-interest spending G and the interest on the national debt $iB^{Non\text{-}Govt}$, while the "dependent" variable is considered to be the budget's deficits, which is determined by the sum of the changes in the value of the

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government bonds plus the change in the monetary base, given that the government will either monetize the deficit or borrow to finance it). Moreover, following the classification of models given by Forrester (1961), the budget model represented above is abstract, as it consists of symbols, not physical objects and nonlinear, because any external effect on it, is not purely additive (an analysis of the nonlinear character of the budget is conducted in the next chapter). Moreover, the model is dynamic, in the sense that it deals with time-varying interactions. In particular, former borrowing patterns affect the state of the system, namely the interest that has to be paid annually is an outcome of the decisions made in past fiscal years and *vice versa* what is decided concerning the fiscal and budget policy in the present will affect future decision-making related to the budget. It can also be characterized as unstable, because "an initial disturbance is amplified, leading to growth or to oscillations whose amplitude increases". Specifically, experience reveals that the first deficits in the national budgets (initial disturbance for the balanced-budget system) led to the amplification and oscillations of budget deficits and public debt (as shown earlier, amplification is the U.S. public debt's behavior, when measured in nominal values and oscillation when it is measured as a percentage of the GDP). This behavior is consistent with Forrester's (1961) opinion, who stated that economic systems are often unstable "wherein small disturbances grow in an unstable manner until restrained by nonlinearities". Such nonlinearities in the budget system are, in general, the limited resources available after a point of deficits' amplification, where investors deny lending their money to countries with high deficits and public debt, or more frequently, the decisions to cut deficits. In addition, the national budget system and model shows

transient behavior, as its "character" changes over time. Lastly, the rule for national

budgets is that they are nowadays open systems, as they are connected to exogenous

variables, which are created outside the model. Though, there are different levels of

openness in each case (i.e. usually countries which run budgets with deficits has more

"open" budget systems than those that run balanced budgets).
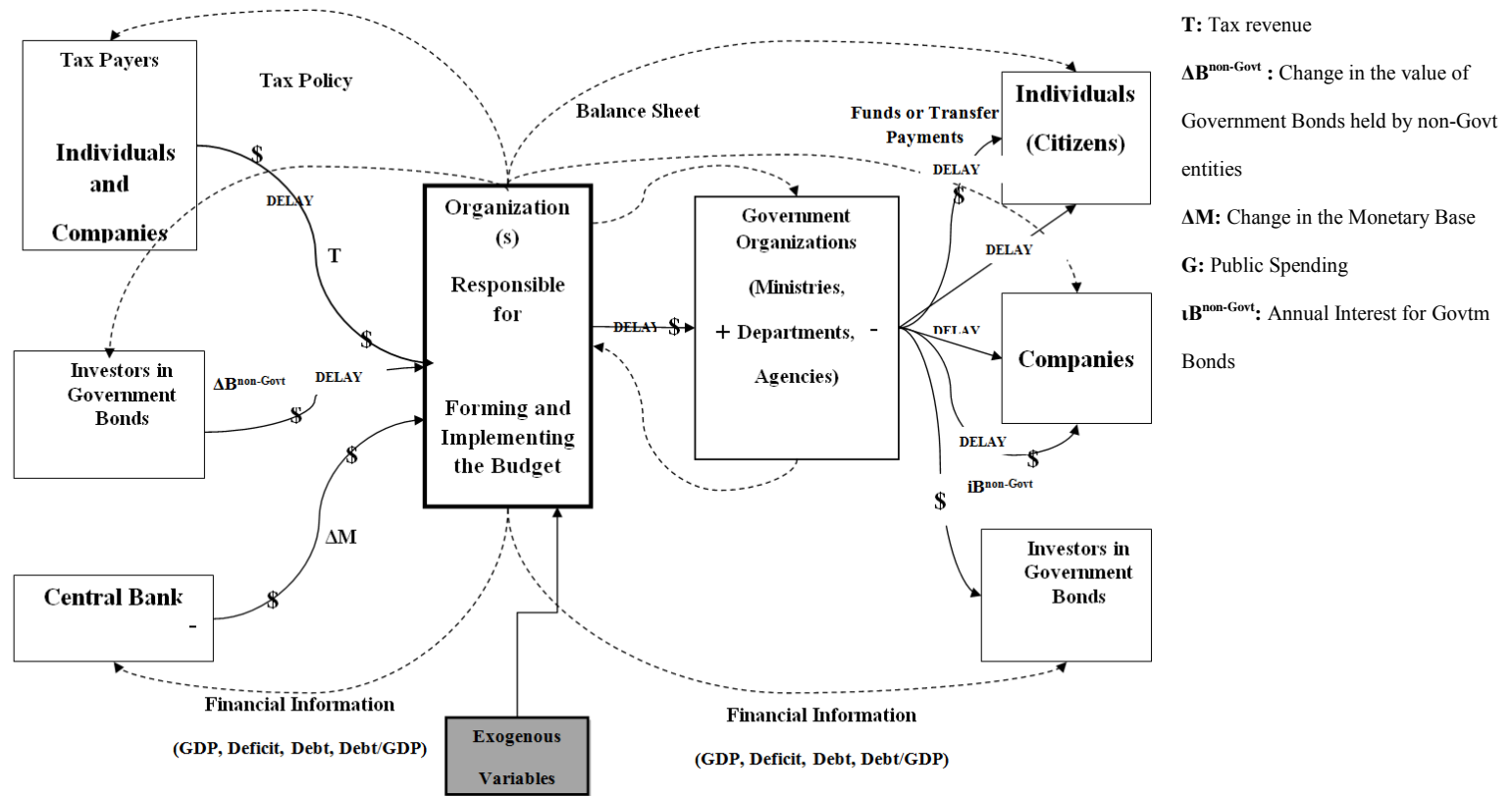
Figure 13. Modeling Budget as a System

The figure contains the following labels and text:

Tax Payers / Individuals and Companies

Tax Policy

$

DELAY

T

Investors in Government Bonds

$\Delta B^{non-Govt}$

DELAY

$

$

ΔM

Central Bank

$

−

Organization (s) Responsible for Forming and Implementing the Budget

DELAY $

Balance Sheet

Government Organizations (Ministries, + Departments, − Agencies)

Funds or Transfer Payments

DELAY

$

Individuals (Citizens)

DELAY

$

Companies

DELAY

$

$

$iB^{non-Govt}$

Investors in Government Bonds

Financial Information (GDP, Deficit, Debt, Debt/GDP)

Exogenous Variables

Financial Information (GDP, Deficit, Debt, Debt/GDP)

Legend:

T: Tax revenue

$\Delta B^{non-Govt}$ **:** Change in the value of Government Bonds held by non-Govt entities

ΔM**:** Change in the Monetary Base

G: Public Spending

$\iota B^{non-Govt}$**:** Annual Interest for Govtm Bonds

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IV. The Dynamics of National Budgets as Systems

Dynamics of National Budgets: Theory and empirical evidence

National budgets, like supply chains, are complex and dynamic systems. Their complexity doesn't involve only the conventional perception about complexity, which is mainly determined by the number of components that comprise a system (millions of taxpayers and companies), but it is derived by the system's dynamic complexity, too. In this chapter, the major sources of budgets' dynamic complexity are identified and it is indicated where Keynesian Theory and Balanced-Budget Theory can fail, concerning the deficits and public debt management.

Dynamics of the Budget System

Dynamics of a system are determined by the feedback processes, the stock and flow structures, the time delays and the nonlinearities that exist inside it (Sherman, 2000).

Feedback Loops

Simply defined, a feedback loop exists when element A in a system affects element B, which in turn affects element C, which at last affects element A (Toole and Hufford, 2004). Generally, the meaning of feedback loops is described by the statements that a system reacts to interventions, which also have unanticipated side-effects to the system when applied (Sterman, 2000), and that any activity in a system affects at last the element that initially performed the activity (Größler et al, 2008). According to Sterman (2000) there are two kinds of feedback loops: The positive feedback loops that are self-reinforcing and the negative loops that are self-correcting.

<u>Representing the feedback structure of Systems with Causal Loop</u>

<u>Diagrams</u>

Feedbacks in a system can be represented with Causal Loop Diagrams (CLD),

which belong to the word-and-arrow diagrams and are widely used in system dynamics

and systems thinking (Richardson, 1997). Sterman, (2000) devoted a whole chapter to the

concept of CLD, in which they (CLDs) are acknowledged as an important tool for

depicting the feedbacks in a system. Specifically, a causal diagram contains variables,

which are connected with arrows and which show a causal relationship. Positive

correlation between the independent and the dependent variable is denoted with (+) ,

while if the former affects the later negatively, it is denoted with a (-). In particular, a

positive link means that "if the cause increases the effect increases above of what it

would be otherwise have been and if the cause decreases, the effect decreases below what

it would otherwise have been" (Sterman, 2000). The opposite happens when two

variables are connected with a negative link: "If the cause increases, the effect decreases

below what it would otherwise have been, and if the cause decreases, the effect increases

above what it would otherwise have been" Sterman (2000). The important loops in a

CLD are highlighted in the diagram with what is known as a loop identifier, which shows

if the loop is negative or positive.

Figure 14 shows a typical example of a causal loop diagram. When the customer

base increases, all else equal, then the sales from word of mouth will be increased above

what it would have been, which in turn, will trigger a further increase of the customer

base. On the other hand, if the customer base increases customer loss rate increases, too,

and this leads to a tendency of restricting the customer base. In the first case, we have a reinforcing (positive) feedback loop (denoted by R), while in the second one there is a balancing (negative) feedback loop (denoted by B).
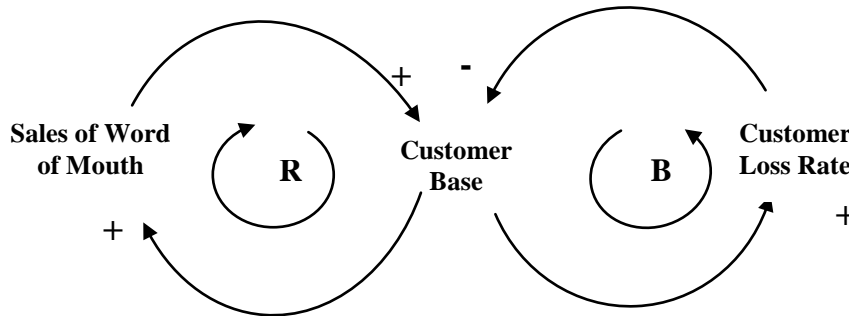
Figure 14. Causal Loop Diagram Notation
Source: Sterman, "Business Dynamics", 2000

In the budget system as presented above, it is apparent that feedback loops are present as taxpayers, companies and investors are the source of the inputs in the system, as well as the recipients of the output; they share, at the same time, the role of supplier and customer in the supply chain model. So, their behavior affects themselves because of this feedback. For instance, if taxpayers do not pay their taxes, they will receive a lesser "amount" of public goods and services or they will have to pay higher taxes in the future, if the lower than expected tax revenue, is financed by borrowing (creation of deficits).

<u>Feedbacks in the Keynesian Model</u>

As aforementioned the Keynesian Theory is based on the assumption that in times of recession governments should run budgets with deficits, in order to stimulate the economy. Such behavior will increase income, help the economy grow and finally reduce the Debt-Income (GDP) ratio in the future. Approaching the Keynesian Theory from a system view, the following Causal Loop Diagram (CLD) (Figure 15) was generated. In this CLD there are two feedback loops. The main variable in the system is the budget deficit. The right balancing feedback loop is a representation of the Keynesian Theory: when deficits are generated, growth is created, too. That means that the income (GDP) will be increased and so the tax revenue will also, which finally reduces deficits. Though, there are two main prerequisites, in order Keynesian Theory to be accurate: The first is that the deficits will be invested in activities that will generate growth and will increase the GDP (the increase must be high enough to create revenue that will be adequate to repay the borrowed amount of funds and the interest as well). The second is that a part of the increase in the tax revenue, because of the amplification of the GDP, will be used to repay the deficits created.

On the other hand, when deficits increase so does the public debt (left part of Figure 15). This in turn, increases the annual interest that should be paid by budget funds annually and there is a tendency for deficits to be increased (or surpluses to be reduced). This is the reinforcing side of the CLD. The final outcome of the policy applied concerning deficit depends on the magnitude of the two opposite tendencies.

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Figure 15 is a justification of the intertemporal GBC, which states that the Debt/GDP ratio can be reduced if the nominal value of debt increases, though, given that the output growth (loop on the right) is greater than the real interest rate (loop on the left).
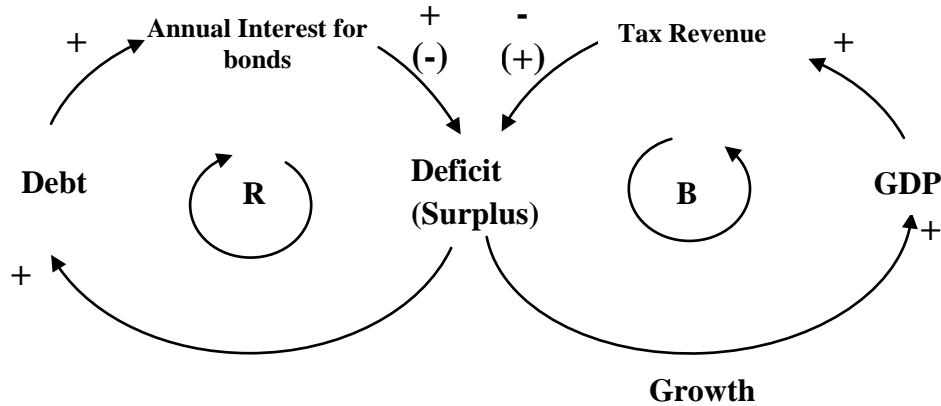
Figure 15. Feedback of the Keynesian Model

<u>Feedbacks in the Balanced-Budget Model</u>

In contrast to the Keynesian approach, the advocates of balanced budgets underscore the need to eliminate or at least reduce deficits. Deficits are reduced either by cutting spending or/and by increasing tax revenue, through a tax rates increase. In both cases feedbacks are present.

Typically, in the case, of increasing tax rates, it is expected that the tax revenue will be greater than before. This is not always true; according to the Laffer's curve, when the level of a tax (i.e. tax rate) exceeds a certain point (point T in Figure 16), the revenue

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raised by the tax will be reduced. Point T represents the optimal tax rate that maximizes tax revenue. Setting tax revenue at any other point than T will cause a reduction in tax revenue.
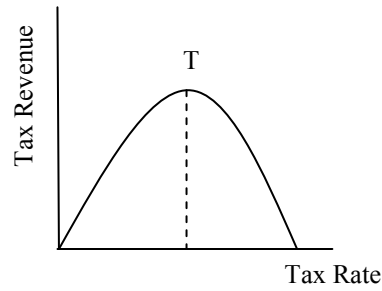
Figure 16. The Laffer Curve

This is justified by the fact that real systems react to interventions, and entities' actions trigger unanticipated side effects. In this case, taxpayers, after point T, reduce their consumption of the taxable object, in the case of an indirect tax or they work less in the case of an income tax (reaction and unanticipated side effect), which in turn offsets the increase in receipts from increasing the tax rate. The outcome of this behavior is the opposite of what was targeted (policy resistance). Instead of an increase, tax revenue finally will be reduced. In other words the Laffer curve can be considered as a case of feedback loop, which is described in the CLD of Figure 17. In particular, when T* (actual tax rate) is less that T (higher point in the Laffer curve) tax revenue will be increased (Case A). On the contrary, if T*>T (Case B), then a feedback loop is triggered, which may lead budget and fiscal policy to a "death spiral". Specifically, when T* surpasses T, the side effects abovementioned are activated and consequently tax revenue declines.

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With any other factor and variable unchanged, this leads to an increase of the budget deficits (we assume that the deficits are covered by borrowing), which may cause a decision of increasing tax rates further, that will, in turn, result in even greater deficits. For example, in 2010 the Value Added Tax (VAT) was raised in Greece from 19%, subsequently to 21% (15/3/2010-Law.3833/2010) and to 23% (1/7/2010-Law. 3845/2010). Although, both changes targeted to increase tax revenue raised by VAT, the measures finally caused the reduction of VAT receipts; VAT revenue for 2010 reached the mount of €15.52 billion while in 2012 it is estimated that the revenue raised by the V.A.T will be €14.89 billion.

When it is tried to reduce deficits by cut spending , the outcome is uncertain, too. There is a potential of policy resistance, as in the case of increasing tax rates. As shown in the following CLD (Figure 18), when a decline in public spending is decided, two opposite reactions are activated inside the budget system. The first one tends directly to reduce the budget deficit, while the second tends to increase it, as cutting outlays tends to reduce the income or/and the consumption and consequently the tax revenue. The final outcome, namely whether deficits will be reduced, eliminated or a surplus will be created, depends on the magnitude of these two opposite behaviors.

+ → **Tax Revenue** ─
DELAY
-
(+)
Deficit
(Surplus)
Tax Rates

Deficit **+**
(Surplus) ← **(-)**
+
Tax Rates **Tax Revenue**
DELAY **-**
DELAY
+ **Side Effects**

Deficit **+**
(Surplus ← **(-)**
+ **-**
(+)
Tax Rates **Tax Revenue**
DELAY **+** **-**
DELAY **DELAY**
+ **Side Effects**
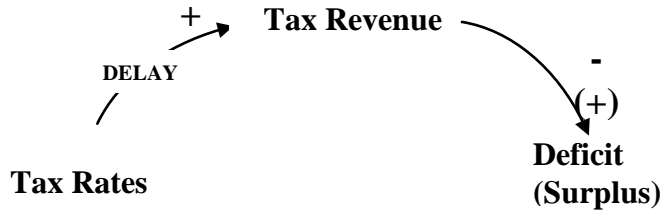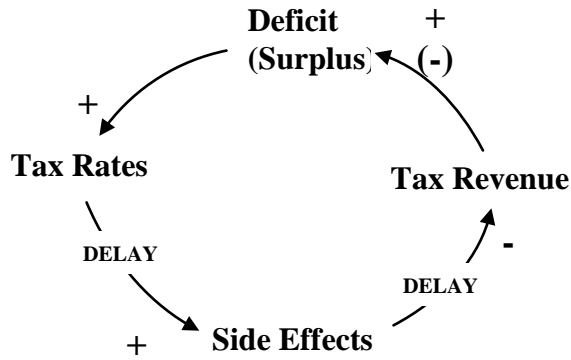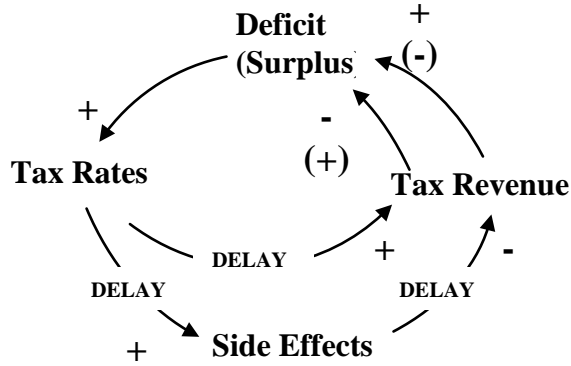
Figure 17. CLD when tax rates increase

-83-
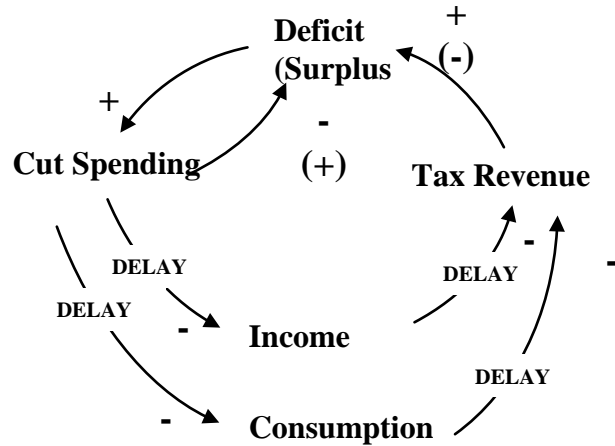
Figure 18. CLD when tax rates increase

Time Delays

Delays are "critical in creating dynamics … [they] give systems inertia, can create oscillations, and are often responsible for trade-offs between the short- and long-run effects of policies" (Sterman, 2000). Moreover, according to research studies, time delays are commonly ignored, even when people know about their existence and their contents, and lead to overshoot and instability (Sterman, 2000).

Time delays are another characteristic present in the national budget process. Time is essential between deciding and implementing a change, and finally cause the effects targeted; when a new tax or a change in the rate of an existing tax is decided, time is needed for the proposal to become a law; thereafter time is needed in order for the

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receipts of the new tax to be gathered, too. Moreover, when financial funds are needed, there is a minimum amount of time required, so as the whole process of borrowing and receiving the money can be completed. Furthermore, bureaucracy in the budget system creates delays. For instance, there is delay in the transfer of the budget funds from the organization responsible for the budget to the government agencies which are financed from it. A same type of delay, due to bureaucracy, occurs in the case of providing the public goods-services. These are only some typical examples of time delays in the budget system.

Problems arise when policy makers do not consider the presence of time delays, conduct analysis concerning the effectiveness of the policies applied early and continue to intervene into the system, as they think the policy implemented will not succeed its goals. This leads to excess interventions, which jeopardize the system's (budget) stability and the success of the policies applied. Let's take, for instance, the case of tax policy. If, for whatever reason, it is decided to be changed, and time delays are not taken into account, policy makers may intervene again into the system, causing sometimes unanticipated behavior. In our previous example, if after the increase in the indirect tax rate, policy makers do not allow enough time to find out the amount of revenue that will finally be gathered by this change, they may increase even more the tax, so as to achieve the receipts goal. This may lead taxpayers to reduce consumption of the taxable object at a rate, that will finally reduce the revenue gathered by this indirect tax (exceed point T in Laffer's curve). In the present research study, delays were depicted in the budget model, as well as in the CLDs.

Nonlinearities

Budgets are non-linear and cases of nonlinearities are apparent in the whole system. For example, tax rates and tax revenue are not connected with a linear relationship, as the principles of superposition $[f(x + y) = f(x) + f(y)]$ or/and homogeneity $[f(kx) = kf(x)]$ are not satisfied. In particular, an increase of 10% in tax rates does not essentially mean that tax revenue will be raised by 10%, because of the side effects that the tax rate increase has to the budgetary elements (particularly to taxpayers).

Stocks and Flows

National budgets, as shown in the supply chain model above, are typical systems of financial, product and services, and information stocks and flows. Research showed that "people's intuitive understanding of stocks and flows is poor" (Sterman, 2000), and this is why stocks and flows should be strongly considered in the budget preparation and implementation stages.

V. Reengineering the Budget Process: Utilizing the Supply Chain Demand Management Process in Budgeting

Introduction

Based on the analysis conducted above, it is concluded that whichever philosophy is adapted (the Keynesian model or the Balanced-Budget theory) it would be useful to approach a budget as a supply chain system, and focus on its dynamics, in order to approach the issues of budget deficits and public debt. At first, special attention should be given to the feedbacks that are present in the system. Specifically, in the Keynesian case, budget policy should be focused on the repayment of the deficits that financed the GDP's growth and on the income's increase *per se* (as it is implied by the intertemporal budget constraint too, the GDP's increase should be high enough to create adequate tax revenue that will be used to pay back the deficit caused). On the other hand, in the Balanced-Budget approach, focus should be given to the causal effects of the actions taken to control debt and reduce/eliminate deficits (increase in tax rates and/or cut in public sending), that results in the opposite of the policy's targets. Furthermore, in both cases time delays, stocks and flows and nonlinearities, that exist in the system, should be identified and considered when designing or/and implementing budget and fiscal policy. The potential outcome of not considering the abovementioned, will be the creation of dynamic complexity, which may be the cause of policy resistance (the interventions to reduce/eliminate deficits and control public debt may be defeated by the system's response to the interventions itself). In particular, experience shows cases where when the Keynesian model was followed, deficits financed growth, but deficits continued to

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increase, even in "boom" economic periods. Likewise, there are cases where the effort to balance the budget led to opposite of what was targeted, namely resulted in further deficits and higher level of debt, too.

In the author's perception, the solution to avoid or face the problems caused by the dynamic character of the budget system is twofold. First, the whole budget process should be reengineered on a basis that will reveal in real time or early enough the feedbacks, the time delays, the nonlinearities, and the system's stocks and flows, in order to prevent the whole system from the unanticipated effects, which these phenomena cause to the national budget. Second, the national budgets' dynamics (feedbacks, time delays, nonlinearities, stocks and flows) must be communicated to policy- and decision-makers, students, even to individuals or/and generally to anyone interested in public economics, so as national budgets to be approached as dynamics systems.

Reengineering the Budget Process: Utilizing Supply Chain Demand Management Process in Budgeting

Reengineering a process involves "the fundamental rethinking and radical redesign of the process, to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed" (Hammer & Champy, 2003). Furthermore, demand management, as presented by Lambert (2008), is the process that intends to balance the customer's requirements with the supply chain capabilities. It is not restricted to just forecasting, but it also includes the synchronization of supply and demand, the increase of flexibility and the reduction of variability, and "can enable a

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company to be more proactive to anticipated demand, and more reactive to unanticipated demand".

Taking into account these two definitions, it can be supported that a national budget is a process of balancing outlays to revenue, by synchronizing supply and demand for financial funds. In that sense, a national budget can be formed and implemented according to the demand management supply chain process principles. Lambert (2008) offers a framework of implementing the demand management process to supply chains, which can be used as a basis for reengineering the budget process, too.

The demand management is segmented into two levels: the strategic and the operational. Each of them consists of sub-processes. While the strategic sub-processes define the structure of managing the process, the operational level consists of the necessary day-to-day operations determined by the strategic sub-processes, which is consistent with the reengineering concept (according to Hammer and Champy (2003) reengineering first determines what to do and then how to do it). Both strategic and operational sub-processes of the supply chain demand management process are shown in Figure 18. Based on this structure, a framework to reengineer the budget process is introduced in the following paragraphs.

The Budget Team

Initially, the national budget team should be formed and staffed with the necessary personnel. Participants should not be limited only to members of the organization(s) responsible for forming, implementing and reviewing the budget (Ministry of Finance or The Department of the Treasury). Instead, the team should include members of all the

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entities involved in the budget process and form a cross-functional team. However, the

core of the team and the control of the team should be maintained to the organization(s)

responsible for the budget. Because of the broadness of the budget process, sub-teams

may be generated, so as the whole process to move faster. For example, a budget team

can be formed in each Ministry or Department, which will cooperate with the budget

team of the organization(s) who is/are responsible for the government's budget

Strategic Sub-Processes	Operational Sub-Processes
Determine Demand Management Goals and Strategy	Collect Data/Information
Determine Forecasting Approaches	Forecast
Plan Information Flow	Synchronize
Determine Synchronization Procedures	Reduce Variability and Increase Flexibility
Develop Contingency Management System	Measure Performance
Develop Framework of Metrics	

Figure 19. The Strategic and Operational Sub Processes of Demand Management Process

Source:Douglas M. Lambert, Editor, Supply Chain Management: Processes, Partnerships, Performance, Third Edition, Sarasota, FL: Supply Chain Management Institute, 2008, p. 89.

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The Strategic Budget Process

The strategic budget process consists of the same 6 sub-processes, as in the case of the demand management process in the supply chain and targets to establish an operational system that matches supply with demand. Figure 20 shows these processes, as well as the budget stages, that each of them should be executed in. An brief analysis of each sub-process is conducted below.
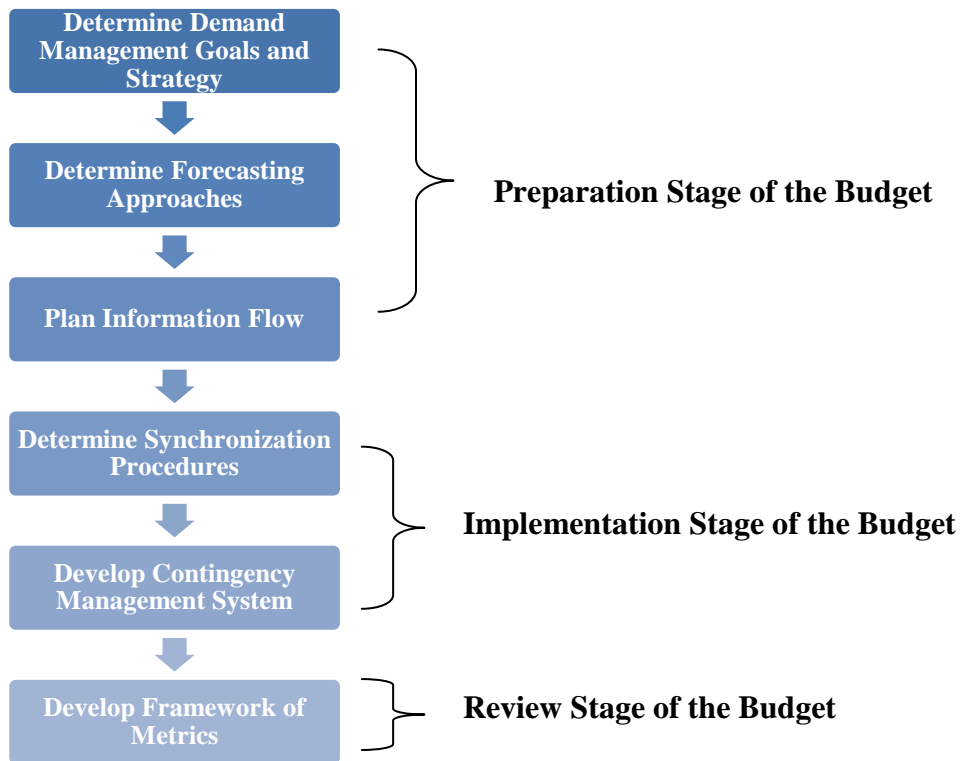
Figure 20. Strategic Sub-Processes and Stages of the Budget

Determine Budget Goals and Strategy

In the first sub-process, the goals of the budget and the strategy that will lead to the accomplishment of these targets, must be identified. A potential statement of determining the budget goals and the strategy to achieve them is: "Reducing deficits by increasing taxation". Usually, neither budget goals nor strategy is in the budget team's authority boundaries. Rather, both are determined, usually, with the team's cooperation by the general economic policy applied.

Determine Forecasting Procedures

The second sub-process is related to forecasting. The budget team has to select the appropriate methods of forecasting the flows throughout the budget's supply chain. Specifically, the team has to forecast, in the preparation stage, the level of tax revenue which depends on the tax rates imposed, the potential amount of borrowing that will be needed, the total government spending and the interest or/and principal, that has to be paid back from previous loans.

It is logical that for each case a different forecasting approach should be applied. Needs for spending are determined by a simple bilateral procedure between the organization that prepares and implements the budget and the other major organizations that are financed directly from it. Specifically, the former asks the later for their financial needs for the next fiscal year in the preparation stage and proposes which part (percentage) of the requests will be satisfied. The final decision of the amount that each government organization will be financed with, belongs to the legislative body, which is authorized to vote for and approve the budget. Adversely, tax revenue estimates are

harder to be precise, because the tax payers' attitude to changes in tax policies is difficult to be predicted. For example, as shown before, if the percentage of an indirect tax is increased, it is not sure that the tax revenue will be greater than before; reduction in consumption may be high enough to offset an increase in revenue. Lastly, forecasts about borrowing financial funds depend on how successful the tax policy is.

Forecasts in the whole system should be as precise as possible. Poor flow predictions, especially in the case of tax revenue, can affect negatively the implementation of the budget; if revenue is finally less than anticipated, the gap has to be filled by creating debt (borrowing) or by cutting expenditure or by monetization of deficits, which may have undesired effects to the whole economic system. As forecasts are based on data, the budget team should determine in this phase the sources, that will provide the information needed for making the necessary estimations.

Plan Information Flow

The last step in the preparation stage for the budget team, is to plan the information flow. In particular, the team must determine the means and other details of transferring the data, as well as which part of the data will be communicated to whom. For instance, although in earlier years the budget's info were communicated through mail, nowadays data transfer is conducted through IT applications, which saves time, financial resources and, additionally, reduces bureaucracy.

Reverse information flow from the organizations financed by the Ministry of Finance or the Department of the Treasury is another important aspect of this sub-process. As financial funds flow from the later to the former, a plan for reverse

information flow should be established, in order to be audited, if the funds were used for the reasons they were released for.

<u>Determine Synchronization Procedures</u>

The next two sub-processes are related to the implementation stage of the budget. The first one involves the determination of the synchronization procedures that need to be established, in order to match the forecasts for financial needs (government spending and annual interest payments) to revenue and borrowing. At the strategic level, that means to generate a plan of automated procedures, which will be applied at the operational level and will align financial needs to funds' supply. An important aspect of this sub-process is the decisions that have to be made by the budget team, concerning the allocation of resources. Specifically, when tax revenue is greater than projected and a surplus is created, there must be a prediction of where the amount of the surplus will be used for. For instance, it may be kept as inventory for future use or it may be used to buy back additional bonds that mature in the near future, so as to reduce the debt. Another possibility is to be used to increase funding in activities, which are already in progress. Though and most importantly, in cases where financial flows to government's organization accountable to run the budget (tax revenue) is not adequate to finance the already approved outlays, an automated procedure with generic guidelines should be present, in order to allocate the insufficient recourses among the other government organizations. Lack of synchronization procedures in this stage of the budget can affect the government's operations and consequently the economy and the society, too. As in

the case of a typical supply chain, software solutions, such as SAP can be applied so as to facilitate the synchronization and pinpoint potential constraints in the whole system.

<u>Develop Contingency Management System</u>

Budgets and supply chains are complex. National budgets are dominated by uncertainty, especially, about the tax revenue that is going to be collected during the fiscal year, about the terms of loans (interest rates) which will prevail the moment that there will be a need to borrow and finally, about the funds that will be needed to face unpredicted events and situations (emergencies such as physical catastrophes i.e. restoration of a road, damaged by a tornado). Within this framework, it is important for the organization responsible for the implementation of the budget, to develop "contingency plans to respond to significant internal and external events that disrupt the balance of supply and demand" (Dobie et al., 2000). For instance, there must always exist an amount of financial funds, which will be used only in emergencies and namely operate as a "safety stock". Generally speaking, there should be documented contingency plans for every possible anticipated case, which may cause a disruption in the budget supply chain. These plans must be rational and must include plans for immediate reaction to every possible threat, that can affect negatively the flows among the entities of the budget supply chain.

<u>Develop Framework of Metrics</u>

The last sub-process at this level consists of developing a framework of metrics and concerns the last stage of the budget. It is important that there is a uniform approach and a common understanding of these metrics throughout the members of the

supply chain (Lambert and Pohlen; 2001). A metric maybe the ratio of the actual outlays to the outlays projected in the budget.

The Operational Budget Process

In this level, all the organizations involved in the budget process must apply what was designed in the strategic level and they must make an effort to reduce variability in their demand and increase flexibility in executing the budget. The operational budget process contains five sub-processes, which are presented below.
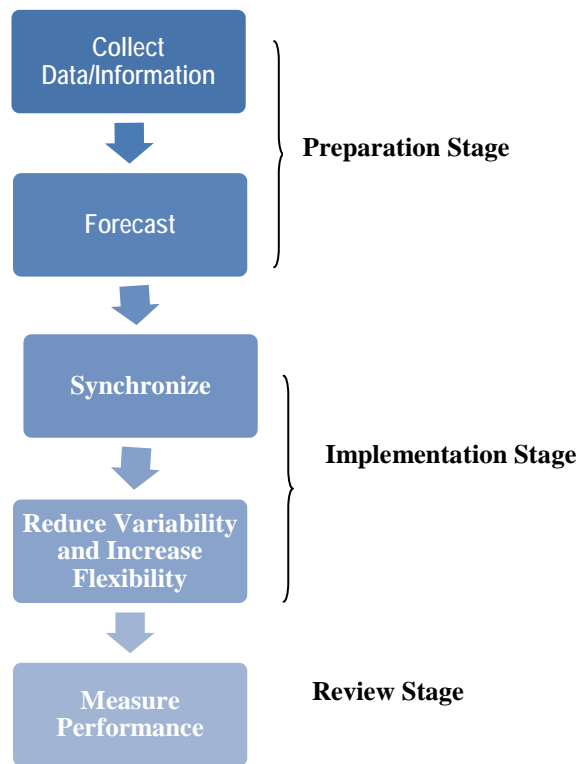
Figure 21. The Operational Sub Processes of Demand Management Process

<u>Collect Data/Information</u>

As mentioned above, at the strategic level, the budget team identifies the sources of data on which the forecasts will be based on (Determine Forecasting Procedures sub-process) and the channels through which the appropriate information will flow throughout the supply chain (Plan Information Flow sub-process). The first step, at the operational level, is to collect the necessary data for synchronizing the budget's supply and demand. Collection of data takes place initially in the preparation stage of the budget process; the budget planner asks from the government's organizations to state their needs for the upcoming fiscal year and receives their applications for financing. So, in this stage the government entities make their forecasts for necessary financing. Collection of data, in the budget process, does not stop in the preparation stage. On the contrary, in the stage of the implementation, the organization responsible for the budget does collect data on a regular basis for the spending of the funds granted to the other government organizations and for the tax revenue gathered, and publishes, as stated before, statements with this data throughout the fiscal year. Moreover, in the audit stage, the organization responsible for the budget collects data that is related to the budget, so as to conduct the appropriate checking.

<u>Forecast</u>

After obtaining and taking into account the data from the government organizations for their financial needs, the budget team conducts its own forecast for aggregate demand for financial funds. Worth mentioning is that in this sub-process, the sum of the requested funds is not necessarily equal to the aggregate demand forecasted by

the budget planner, because it is likely that some of the demands will not be satisfied, due to insufficient resources.

Synchronize

As the forecast of financial needs has been made by the budget team, the next step is to synchronize supply and demand. That is to collect the taxes and borrow, if needed, any additional funds, and transfer them to the government agencies according to the budget's guidelines.

Reduce Variability and Increase Flexibility

In this sub-process the budget team has a twofold goal. First, variability has to be reduced in the whole system. Focus should be given in the variability of the tax revenue. As it determines the success of the budget policy on a large scale, appropriate measures should be taken, so as to reduce cases of deviations, between the anticipated tax revenue and the actual tax receipts. Though, as variability is unavoidable, flexibility should be built in the budget system, too. The budget team should be flexible enough to face any disturbance in the whole system. In the previous example, there should be appropriate mechanisms that will cover the gap between the expected and the actual tax revenue, such as an amount that will be kept to the treasury as a "safety stock".

Measure Performance

In the last sub-process, the budget team must measure the performance of each year's budget, according to the metrics developed in the strategic level. For instance, a measure of performance maybe the ratio of the actual tax receipts to the anticipated tax revenue.

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The role of Information Technology to Reengineering Budget - Conclusions

The whole reengineering process as described above will help policymakers and the budget team to identify early enough and react to the feedbacks, triggered by the interventions to the system. Moreover, a budget process based on Lambert's principles will reveal the time delays, stocks and flows and nonlinearities, when they appear in the system. For instance, in cases where revenue falls short of what was projected and/or where government organizations delay in the implementation of their programs, will be signaled in the system, so as corrective actions can be taken. It is apparent that a well-structured communication channel is a prerequisite for these signals to show up in the system, when a disturbance occurs. In general, Information Technology (IT) is a key player to reengineer the budget process. Transfer and monitoring of real-time data is a requirement for success. In that sense, IT is the main enabler of achieving a reengineered budget process, but it is not adequate *per se*.

VI. The Budget Management Flight Simulator

Introduction

Considering a national budgets' dynamic complexity described above, which results in phenomena of policy resistance, we now proceed to the second step of a typical system dynamics project, which is "Simulation/Experiments", by introducing a proposal for a Management Flight Simulator (MFS). Its mission will be to develop a learning tool for policy-makers, students and any others interested in public economics, which will reveal the dynamics of the national budget system, as the Beer Game does in the case of the supply chain. Its utility and necessity derives from the fact that there are a lot of misperceptions and misunderstanding about fiscal and budgetary policy, deficits and debt. Particularly, there are people who think that drastic reductions in outlays or/and radical increases in tax rates will solve the problem of debt, while others believe that just stimulating the economy with further deficits will increase income and the public debt will be controlled. Both approaches ignore the feedbacks, death spirals, delays and nonlinearities existent in the budget system. In other words, like in the case of the supply chain with the Beer Game, a similar tool should be developed, that will expose simply and comprehensively the complexity of the budget system.

It should be mentioned that the establishment of a MFS concerning the national budget and the fiscal policy is a novel idea, but the development of the simulation software goes far beyond the scope of this research study. Though, it is intended to be the next assignment of the author of the present thesis.

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General Concept - Rules

The purpose of the MFS is to show players that budgets are dynamic systems, where feedbacks, delays, nonlinearities, and stocks and flows produce dynamic complexity, which in turn is a main cause of policy resistance. Within this framework, the player in the simulation will be given the role of the decision-maker, concerning the budget and the fiscal policy, and a certain target of public debt and/or budget deficit/surplus will be assigned to be achieved. Thereafter, certain scenarios of fiscal policy and budgetary issues will be produced by the simulator and the player will have to make decisions to face these situations, from a predetermined menu of choices. Each choice will have an impact on the budget's deficit and on public debt, and the player's performance will be evaluated due to the final outcome that his decisions will have on the deficits-surplus-debt. The main purpose of the MFS will not be to create a game of competition, although good results are the players' target. Rather, the main objective will be to familiarize players with budget's complexity, by presenting examples in which budgets behave as systems that typically resist changes. Within this framework, "real" policy resistance cases should be included and emphasized in the scenarios presented. Considering the abovementioned, an example is presented below that shows a potential scenario-question of the MFS:

Scenario-Question: Reports for the outlays needs have been received. After a close exanimation, it is found that $X extra billion of outlays will be needed for the healthcare bill for the next fiscal year. You obtain these extra funds by:

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A. Issuing Bonds and Borrowing $X billion

B. Raise the Sales Tax by 2%

In case the player chooses answer A, there will be an increase of debt by $X billion. On the contrary, if he chooses answer B, although it will be expected the revenue to be increased the impact on the debt will be greater that $X billion, for instance $Y>X billion. Of course, it will be explained to the player that this is not an arbitrary result of the simulator, but the outcome of his decision: By raising sales tax by 2%, consumption declined, because prices increased and this caused the revenue's reduction. This paradigm that lies in the Laffer's curve, will teach players that interventions in the budget system (i.e. a raise in the tax rates) may trigger the opposite behavior and results than those anticipated, because they cause side effects (reduction in consumption) that may even outpace the intervention's outcomes. It would be ideal to connect these scenarios-questions with real data (find a real case where, when sales tax was raised, actual tax revenue was reduced) and present them to players, in order to emphasize the budget's dynamics and give credibility to the MFS.

Technically, the first version of the MFS will be a one player simulator; later versions may include more players. In addition, the simulation software that will be chosen for the MFS, should be relevant to the needs of the study and "friendly" to the user. Moreover, after being created and tested, the Budget MFS should be forwarded for use to anyone interested to enhance his understanding in public economics. Thereafter, it is proposed to gather data and analyze the decision-makers' behavior, like Sterman

(1989) did in the case of the supply chain with the Beer Game. It would be interesting, novel and useful to investigate the potential of patterns in human behavior that has to do with budgetary and fiscal policy decisions.

VII. Conclusions and Recommendations

The novelty of this research study lies in the fact that the national budget is modeled as a system for the first time in the literature. An extensive analysis showed that no other study has linked and/or applied, until now, the systems theory to the fiscal – budgetary policy. Specifically, in this thesis, it is identified that the national budget is a complex and dynamic system. Its dynamics consists of feedbacks, time delays, stocks and flows, and nonlinearities, which cause dynamic complexity, jeopardize the achievement of the budgetary goals and can be the source of policy resistance cases.

Within this framework, policy-makers, whether advocates of the Keynesian Theory or loyal to the Balance Budget approach, should consider that budgets are systems, consisting of a plethora of entities which interact within the system's boundaries. Any budgetary decision triggers various side effects, in addition to what is intended and targeted, which should be considered in advance or, if it is not possible to be predicted, as soon as they appear in the system. Special attention should be given to exogenous variables that affect the system and tend to influence the budget's and its entities state, too.

Identifying dynamic complexity is not a simple task. Rather, it is a challenging issue. However, reengineering the budget process on the basis of the supply chain demand management process, can result in identifying the budget's dynamics early enough to take action and avoid unwanted phenomena and results. Furthermore, as in the case of the supply chain with the Beer Distribution Game, a Management Flight Simulator should be developed, in order to act as a learning tool about the budget's

dynamics and reveal the complexity of the budget as a system. In other words, its primary purpose should be to emphasize the national budgets' complex and dynamic character.

Another novelty of this research study is that national budgets were mapped as a special case of a supply chain and modeled as a supply chain system. Of course, budgets can be modeled as a different kind of system, too. Nevertheless, the supply chain approach includes the characteristics needed to give a comprehensive and easily understandable picture of the whole system.

Recommendations for Further Research

As aforementioned the novelty of the present thesis lies in the fact that the national budget is considered to be and it is modeled as a system, specifically a supply chain system. As such, this research study can be considered as the first step in a new field of thinking, where budgets are modeled and analyzed as systems and/or supply chains. In particular, this project contains the theoretical background of mapping and modeling the national budget as a supply chain and as a system, respectively.

Within this framework, reengineering the budget process on the basis of the supply chain demand management process, can result in identifying the budget's dynamics early enough to take action and avoid unwanted phenomena and results. Furthermore, as in the case of the supply chain with the Beer Distribution Game, a Management Flight Simulator should be developed, in order to act as a learning tool about the budget's dynamics and reveal the complexity of the budget as a system. Specifically, areas of potential future research may enclose a case study where a country's budget will be modeled as a supply chain system or just as a system.

Furthermore, follow-up research may include the identification of cases where the budget's dynamics caused the opposite results of what was targeted by the policies implemented (case studies of policy resistance caused by the budget dynamics). In general, this study introduced the idea that budgets are systems and further research may focus on additional issues concerning the implementation of system's theory to budgeting.

Furthermore, in this study, it is introduced a conceptual basis for reengineering the national budget procedure, according to the postulates of the demand management process of a supply chain. Future researchers and policy makers may consider this framework when proposing or applying changes to their countries' budgeting process.

Finally, the present thesis makes a proposal to develop a Management Flight Simulator for national budgeting. Future research must, in the author's opinion, include the establishment of a Management Flight Simulator, concerning the national budget's dynamics. It is not only that the MFS will be useful to policy makers, students or academics; if it is, as simple and successful in accomplishing its purposes as the Beer Distribution Game, in the case of the supply chain, it will make everyone understand what a budget is: a system, whose dynamics (feedbacks, nonlinearities, stocks and flows, and time delays) makes its management much more complex than it appears to be today.

Appendix A: OECD - Government deficit: Net lending/net borrowing as a percentage of GDP, surplus (+), deficit (-)

		2006	2007	2008	2009	2010	2011	2012	2013
	Australia	2.3	1.8	-0.8	-4.5	-4.7	-3.9	-2.2	0.4
	Austria	-1.7	-1.0	-1.0	-4.2	-4.5	-2.6	-2.9	-2.3
	Belgium	0.3	-0.1	-1.0	-5.7	-3.9	-3.9	-2.8	-2.2
	Canada	1.6	1.4	-0.4	-4.9	-5.6	-4.5	-3.5	-2.4
	Czech Republic	-2.4	-0.7	-2.2	-5.8	-4.8	-3.1	-2.5	-2.2
	Denmark	5.0	4.8	3.3	-2.7	-2.7	-1.9	-3.9	-2.0
	Estonia	2.5	2.4	-2.9	-2.0	0.3	1.0	-2.0	-0.3
	Finland	4.0	5.3	4.2	-2.7	-2.9	-0.9	-0.7	-0.0
	France	-2.4	-2.7	-3.3	-7.6	-7.1	-5.2	-4.5	-3.0
	Germany	-1.7	0.2	-0.1	-3.2	-4.3	-1.0	-0.9	-0.6
	Greece	-6.0	-6.8	-9.9	-15.6	-10.5	-9.2	-7.4	-4.9
	Hungary	-9.4	-5.1	-3.7	-4.5	-4.3	4.2	-3.0	-2.9
	Iceland	6.3	5.4	-13.5	-10.0	-10.1	-4.4	-2.6	-1.4
	Ireland	2.9	0.1	-7.3	-14.0	-31.2	-13.0	-8.4	-7.6
	Israel (1)	-2.5	-1.5	-3.8	-6.4	-5.0	-4.4	-4.3	-4.2
	Italy	-3.4	-1.6	-2.7	-5.4	-4.5	-3.8	-1.7	-0.6
	Japan	-1.3	-2.1	-1.9	-8.8	-8.4	-9.5	-9.9	-10.1
	Korea	3.9	4.7	3.0	-1.1	1.3	1.8	2.3	2.8
	Luxembourg	1.4	3.7	3.0	-0.8	-0.9	-0.6	-1.4	-1.1
	Netherlands	0.5	0.2	0.5	-5.5	-5.0	-4.6	-4.3	-3.0
	New Zealand	5.3	4.5	0.4	-2.6	-4.2	-8.2	-4.4	-2.9
	Norway	18.3	17.3	18.8	10.6	11.2	13.6	15.1	16.3
	Poland	-3.6	-1.9	-3.7	-7.4	-7.9	-5.1	-2.9	-2.2
	Portugal	-4.6	-3.2	-3.7	-10.2	-9.8	-4.2	-4.6	-3.5
	Slovak Republic	-3.2	-1.8	-2.1	-8.0	-7.7	-4.8	-4.6	-2.9
	Slovenia	-1.4	-0.0	-1.9	-6.1	-6.0	-6.4	-3.9	-3.0
	Spain	2.4	1.9	-4.5	-11.2	-9.3	-8.5	-5.4	-3.3
	Sweden	2.2	3.6	2.2	-1.0	-0.1	0.1	-0.3	0.3
	Switzerland	0.8	1.7	2.3	1.0	0.6	0.8	0.6	0.6

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	United Kingdom	-2.7	-2.8	-5.0	-11.0	-10.3	-8.4	-7.7	-6.6
	United States	-2.2	-2.9	-6.6	-11.6	-10.7	-9.7	-8.3	-6.5
	Euro area (15 countries)	-1.4	-0.7	-2.1	-6.4	-6.2	-4.1	-3.0	-2.0
	OECD-Total	-1.2	-1.3	-3.4	-8.1	-7.5	-6.3	-5.3	-4.2

Last updated: 7 June 2012

1. The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights. East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Source: OECD Economic Outlook No. 91. OECD Economic Outlook: Statistics and Projections (database)

Appendix B: General Government Gross Financial Liabilities as a percentage of GDP
OECD Economic Outlook No. 91, OECD Economic Outlook: Statistics and Projections (database)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Australia	40.3	42.0	39.2	37.5	32.4	| 28	25.0	22.1	20.1	18.6	16.8	16.3	15.6	14.5	13.8	19.4	23.5	26.6	28.7	27.8
Austria	65.3	69.5	70.3	66.2	67.8	70.8	70.5	71.6	72.8	71.1	70.9	70.6	66.4	63.4	68.7	74.4	78.1	79.7	83.0	84.4
Belgium[1]	137.7	135.3	133.2	127.8	123.1	119.5	113.6	111.9	108.3	103.3	98.3	95.8	91.6	87.9	92.9	99.9	100.0	102.3	103.1	102.0
Canada	98.0	101.6	101.7	96.3	95.2	91.7	82.4	82.9	80.8	76.8	72.8	71.8	70.4	66.7	71.2	82.4	84.0	83.8	84.5	81.4
Czech Republic	..	..	..	..	..	..	..	..	31.5	33.2	33.2	32.8	32.5	31.0	34.4	41.0	45.5	48.3	50.7	52.6
Denmark	85.8	81.7	79.1	74.8	72.4	67.1	60.4	58.4	58.2	56.6	54.0	45.9	41.2	34.3	41.4	51.2	54.8	61.8	63.0	64.8
Estonia	..	13.3	12.3	11.3	10.0	10.9	9.4	8.9	10.2	10.8	8.5	8.2	8.0	7.3	8.5	12.7	12.5	10.0	12.7	12.8
Finland	60.7	65.3	66.2	64.7	61.2	54.9	52.4	49.9	49.5	51.4	51.5	48.4	45.6	41.4	40.4	51.8	57.6	57.2	59.1	61.8
France	60.1	62.6	66.4	68.9	70.4	66.9	65.7	64.3	67.5	71.7	74.1	76.0	71.2	73.0	79.3	91.2	95.8	100.1	105.5	107.3
Germany[2]	46.5	55.7	58.8	60.4	62.3	61.8	60.8	60.1	62.5	65.9	69.3	71.9	69.8	65.6	69.8	77.4	86.8	87.2	88.5	87.8
Greece	..	102.0	104.1	100.9	98.6	102.4	116.4	119.2	118.6	113.3	115.8	113.4	117.0	115.4	118.7	134.0	149.6	170.0	168.0	173.1
Hungary	91.9	88.5	76.8	67.0	65.2	67.5	62.1	60.0	60.7	61.7	65.5	68.7	71.9	72.9	77.0	86.2	86.4	84.7	84.8	84.1
Iceland	..	..	..	..	77.3	73.6	72.9	75.0	72.0	71.0	64.4	52.6	57.4	53.3	102.1	120.0	125.2	128.3	126.7	124.7
Ireland	..	..	..	..	62.6	51.7	39.7	36.8	35.8	34.5	33.1	32.9	29.0	28.6	49.5	71.1	98.4	114.1	121.6	126.9
Israel	..	..	..	..	101.0	94.8	84.3	89.0	96.7	99.3	97.7	93.7	84.7	78.1	77.1	79.5	76.1	74.2	73.9	73.2
Italy	120.3	121.9	128.1	129.6	131.8	125.7	120.8	120.1	118.8	116.3	116.8	119.4	116.7	112.1	114.6	127.7	126.5	119.7	122.7	122.1
Japan[3]	80.2	87.8	95.4	102.0	115.0	128.9	137.5	144.6	153.4	158.2	166.2	169.5	166.7	162.4	171.2	188.8	192.7	205.5	214.1	222.6
Korea[4]	..	..	..	..	..	..	..	..	19.2	19.7	23.3	25.5	28.5	28.7	30.4	33.5	34.6	34.7	34.5	33.9
Luxembourg	..	..	..	..	16.2	14.8	13.4	13.5	12.2	13.1	14.0	12.1	11.5	11.3	18.3	18.0	24.7	23.9	26.0	28.7
Netherlands	86.6	89.5	88.0	82.1	80.7	71.6	63.8	59.4	60.2	61.3	61.9	60.7	54.5	51.5	64.8	67.5	70.6	75.2	81.0	83.6
New Zealand	56.8	50.7	44.3	41.7	41.6	39.0	36.9	34.9	33.0	30.9	28.2	26.9	26.6	25.7	28.9	34.5	37.4	44.3	48.4	50.5
Norway	34.6	37.9	33.6	29.7	28.0	29.1	32.7	31.8	39.0	48.4	50.9	47.8	59.0	56.8	54.3	48.9	49.6	34.0	28.1	20.2
Poland	..	51.6	51.5	48.4	44.0	46.8	45.4	43.7	55.0	55.3	54.8	54.8	55.2	51.8	54.5	58.4	62.3	63.3	62.9	62.3
Portugal	..	66.7	66.5	65.2	63.1	60.4	60.1	61.5	64.8	66.5	69.1	72.6	77.3	75.4	80.7	92.9	103.2	117.6	124.3	130.1
Slovak Republic	..	38.2	37.6	39.0	41.2	53.5	57.6	57.1	50.2	48.2	47.6	39.2	34.1	32.9	32.0	40.4	47.1	46.8	52.1	54.2
Slovenia	..	..	..	..	..	..	..	33.6	34.7	34.1	34.9	34.0	33.8	30.7	30.4	44.3	48.4	56.4	60.3	63.2
Spain	64.3	69.3	76.0	75.0	75.4	69.4	66.5	61.9	60.3	55.3	53.3	50.7	46.2	42.3	47.7	62.9	67.1	75.3	87.9	90.9
Sweden	82.5	81.1	84.4	83.0	82.0	73.2	64.3	62.7	60.2	59.3	60.0	60.8	53.9	49.3	49.6	51.8	48.9	48.7	48.0	46.0
Switzerland	45.5	47.7	50.1	52.1	54.8	51.9	52.4	51.2	57.2	57.0	57.9	56.4	50.2	46.8	43.6	42.5	41.7	41.0	40.8	39.4
United Kingdom	46.8	51.6	51.2	52.0	52.5	47.4	45.2	40.4	40.8	41.5	43.8	46.4	46.0	47.2	57.4	72.4	81.9	97.9	104.2	108.2
United States	71.1	70.7	69.9	67.4	64.2	60.5	54.5	54.4	56.8	60.2	68.0	67.6	66.4	67.0	75.9	89.7	98.3	102.7	108.6	111.2

Euro area	71.1	75.5	80.0	81.0	81.6	78.2	75.9	74.4	75.3	76.0	77.3	78.1	74.7	71.8	77.0	87.8	93.1	95.1	99.1	99.9
Total OECD	70.0	72.6	74.2	73.9	74.5	72.9	70.2	69.9	71.9	73.7	77.8	78.1	76.0	74.5	81.0	92.5	98.7	103.0	107.6	109.3

Note: Gross debt data are not always comparable across countries due to different definitions or treatment of debt components. Maastricht debt for European Union countries is shown in Annex Table 61.

For more details. see *OECD Economic Outlook* Sources and Methods *(http://www.oecd.org/eco/sources-and-methods)*.

For euro area countries with unsustainable fiscal positions that have asked for assistance from the European Union and the IMF (Greece. Ireland and Portugal) the change in 2010 and 2011 in government financial liabilities has been approximated by the change in government liabilities recorded for the Maastricht definition of general government debt (see Box 1.2 on policy and other assumptions in Chapter 1).

1. Includes the debt of the Belgium National Railways Company (SNCB) from 2005 onwards.
2. Includes the debt of the Inherited Debt Fund from 1995 onwards.
3. Includes the debt of the Japan Railway Settlement Corporation and the National Forest Special Account from 1998 onwards.
4. Data are on a non-consolidated basis
(SNA93).

Source: OECD Economic Outlook 91 database.

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Vita

Captain Christoforos Kalloniatis was born in 1978, in Mytilene, Greece. In 1995, he graduated from the 4th General Lyceum of Mytilene, Greece and enrolled in the Hellenic Armed Forces Corps Officers Academy (SSAS). In 1999, he was commissioned as Finance 2nd Lieutenant. During his studies in SSAS, he attended the School of Economics at the Aristotle University of Thessalonica and graduated with a Bachelor in Economic Sciences (1999).

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14. ABSTRACT
In the Science of Economics, there has been a debate about the optimal fiscal and budgetary policy that should be implemented by governments. On the one side, the advocates of the Keynesian Theory assert that in recession times governments should run budgets with deficits, in order to stimulate the economy, while the supporters of the Balanced Budget Theory, on the contrary, underscores the need to reduce and even eliminate the budget deficits. However, previous experience shows that both theories often failed to accomplish their goals, because they underestimated a very sensitive parameter: national budgets are not just an estimate of revenues and receipts or a simple statement. Rather, they are systems, the entities of which interact with each other and respond to any event affecting their state. Even further, a national budget can be considered as a special case of a supply chain system.   Within this framework, the present thesis seeks to introduce a new aspect in budgeting. Specifically, the national budget is mapped as a supply chain and modeled as a system. Thereafter, the research focuses on and explores the budget's dynamics, which are responsible for the failures experienced in the fiscal and budgetary policy and concludes with a proposal for reengineering the budgeting process, according to the postulates of the demand management process in a supply chain. Lastly, it underscores the need to develop a Management Flight Simulator, which will reveal the dynamics of national budgets, as the Beer Game does in the case of the supply chains, and that will act as a learning tool for anyone interested in budgeting, supply chains or/ and public economics.

15. SUBJECT TERMS
National Budget, economic policy, public debt, systems theory, Budget Management Flight Simulator, Budget Supply Chain System

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