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Article

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The Impact of Ageing Population on the Social Security Budget: Case Study for Brazil, China, Germany, Japan, and the United States

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Abstract: This study estimates the hypothetical level of contributions collected and pensions paid in the future by the social security budget in five of the most influential countries in the world today. Historical data from 1980 to 2009 declared by each state's monitoring organization have been analyzed in order to find and propose a forecasting model for the period 2010-2025. Two models have been developed based on global specialists' data for complex forecasts on population changes and economic prospects: one both measuring and forecasting the contributions gathered for the social security budgets, and one forecasting the levels of pensions paid. The focus of the analysis is on the effects that an ageing population could have on social security budget. The models suggest that there is a real need for change in the social security systems in use in order to strategically avoid predictable deficits and achieve budgetary equilibrium.

Keywords: Ageing Population, Social Security

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1. Introduction

Social security is generally defined as any program of social protection established by legislation, or any other mandatory arrangement, that provides individuals with a degree of income security when faced with the contingencies of old age, survivorship, incapacity, disability, unemployment or rearing children. When we talk about a secure and healthy public pension system, we talk about a well managed, sustainable system. At the same time, when we talk about an efficient public pension system we must refer to an active social security program.

This paper presents the development of social security programs and systems in five of the most influential countries in the world: China, Brazil, Japan, Germany and the US. Either developing or developed countries must improve their public systems, and that usually implies a better management of the social security reform process. At the moment, social security programs worldwide face serious challenges, including the impact of globalization, the ageing of the population, lack of coverage, evolving labor markets, changing family structure and many other challenges. According to UN forecasts (UN, 2004), life expectancy is rising in most countries, and for e.g. European countries, life expectancy at birth will increase from 73.8 in 2005 to 81 in 2050. Most countries face the challenge of how to exploit the opportunities arising from increasing longevity and the implied increase in the share of old people in populations (see EU, 2006; IMF, 2004). Torben M. Andersen (2008) examined the issues concerning to increasing longevity, and concluded that when longevity increases, the retirement age is raised more than proportionally to the increase in longevity, but the young also make larger transfers to the old.

Faced with all these challenges and the need to adapt, the social security reform process deserves to be fully understood. Orazio Attanasio, Sagiri Kitao, Giovanni L. Violante (2007) studied how sustainable the current social security systems are in the developed economies, given the projected demographic trends, and observed a need for social security to adapt and to better guarantee sustainable and more accessible aid/pension resources. In a perfect world, systems should be built on integrated, proactive and innovative policy responses. Also, Roel

Beetsma, Leon Bettendorf, Peter Broer (2003) explored the consequences of ageing for the Netherlands, discussed the sensitivity of the results under alternative projections for population ageing, and explored the effects of three types of social security reform, a reduction in benefits, an increase in the retirement age, and smoothing of the public pension premium over time. We are in agreement to the results of their study, that the welfare effects of ageing and the reforms are substantial.

Strategies and tools to analyze the function, strength and stakes involved in these attempts are very important to any political system, because they constitute a key to better understand reform outcomes. In general, major reform processes are determined by governments, but social security institutions also have an important role to play; in this way social security institutions may be better equipped to engage actively with the reform process. Some of the many challenges that social security institutions must face are the demographic changes over time, and also the real long-term impact of these changes. In developed countries, rising costs in the pension area represent an important threat to both the general economy and to public budgets. Recently, many developing countries are confronted with a significant increase in their elderly population, and in consequence, an old-age pension system that is not able to adapt to all these changes and to the growing social needs of their societies. As such, it is a fact that the increase in elderly population is a real issue that any country has to deal with, both socially and financially.

In accordance with many recent studies (ISSA, 2010), we need to emphasize that „ageing” relates not only to an increasing proportion of the elderly population, but overall to a large area of changes, like: a diminishing younger population due to a declining fertility rate, an increasing life-expectancy in terms of population, an increasing number of old and very old persons who may require support through the pension system. Concerning social security programs, the ageing population process has an important impact: on the one hand, it leads to an increasing dependency ratio between the working and the non-working population, and on the other hand, it possible increases the dependency ratio between the healthy and the non-healthy population.

Therefore, the governments must face all the demographic changes using the most efficient strategies available. They also need to learn to adapt their policies to the ageing of the population in order to achieve their

long-term objectives and to protect people in an adequate and sustainable way. Continuing the idea, all countries and all social security branches are, in fact, challenged by demographic changes. As such, our purpose is to observe and analyze how some of the most influential countries do so in order to ensure the sustainability of their public pension system. Evidence shows that many social security institutions have taken measures to adapt to all the changes regarding either the rising proportion of old-age people or the diminishing proportion of newborn infants. It is absolutely correct to say that the stability of the public pension systems must be maintained at a certain degree over time, mainly focusing on medium and long term. Consequentially, we can conclude that this is the real challenge for social security institutions.

In this paper we will test if the policies adopted by the public pension systems from the US, China, Japan, Brazil and Germany are able to ensure long term stability to the systems established in each of these countries. In order to reach our goal, we will review the public pension system, focusing on what type of strategies were used in the last three decades (1980-2009) by governments from each country mentioned above. In the following, our aim is to define a suitable function with which we can take all the previously collected dates to the future and thus establish a correct prediction of the public pension system. There are several branches of the literature related to this aspect. Juan F. Jimeno, Juan A. Rojas, Sergio Puente(2008) studied the effects of population ageing on Social Security expenditures, comment on the weaknesses and strengths of each of them, and perform a quantitative analysis by comparing the results they imply in the particular case of the Spanish economy. Also, Henning Bohn(2008) examined the viability of social security, taking into account the political point of view, and seeking if Social Security will remain viable as the U.S. population is ageing. A very relevant study had been developed by John B. Williamson, and Fred C. Pampel(2002). They compare four nations (the United States, United Kingdom, Germany and Sweden) with respect to plans for dealing with the anticipated pension burden due to the retirement of the baby boom generation. Hamid Faruquee, Martin Mühleisen examined the economic implications of population aging in Japan; they also estimated the output loss caused by demographic changes and assessed the impact of ageing on Japan's government finances.

2. Pension systems adopted by some of the richest economies around the world

In this paper we investigate the implications of policies adopted by governments from some of the richest economies in the world: the United States, China, Japan, Germany and Brazil. We also want to extend our work by using a forecast function to model several databases in order to observe if current social security systems used by the governments from the countries mentioned above have the ability to build and develop appropriate reforms for maintaining pension system stability in the context of ageing population as a result of increasing life expectancy and declining fertility rate (Câmpeanu, 2011). The process of globalization has a big impact on society. The ones most affected by these changes are old people, due to the fact that they are unable to adapt to all the new improvements in technology which represent a decisive edge for modern professional workers. The results of these events are found in the increasing number of unprofessional employees with low monthly income, which in turn leads to lesser contributions collected for the social security budget. Due to all these problems, governments need to implement new reforms in order to provide a more stable and sustainable social security budget.

As such, in the past few years, governments have applied pension reforms aimed at inducing older workers to defer retirement and stay employed longer. The forces of globalization are placing countries under competitive stress. Generally, for social security systems, globalization poses a risk of declining coverage, and at the same time globalization creates a pressing need to assure social security coverage for workers in more precarious jobs. Therefore, public pension system must adapt to the demographic changes that have been registered in the last decades, especially in industrialized countries. A serious issue which must be taken into account by any government is life expectancy rate whose trend rises continuously in most of the countries. At a global level, statistics show us a significant increase in life expectancy by almost 20 years. At the same

time, fertility rates have fallen well below the required fertility rate of 2.1 births per woman (ISSA, 2010).

At the beginning of the 21st century, for every 10 Germans no more than 7 children are being born, and life expectancy is increasing by 1 year every 8 years. By the year 2035, the ratio of old to young will have almost doubled and only thereafter will the situation improve. Germans will have the oldest population on earth by around 2030. These facts will lead to a crisis of the pay-as-you-go pension system (see Sinn, 2000). Until 2016, a reform can be democratically enforced. After 2016, Germany will be a gerontocracy (see Hans-Werner Sinn, Silke Uebelmesser, 2003).

Increasing life expectancy rate and also declining fertility rate have a negative influence on a public pension system. We can say that the negative influence, mentioned above, may also come as a result of decreasing working population and increasing number of retired persons, the problem being faced by many countries around the world. Facing all these events causing financial difficulties, governments are unable to maintain the sustainability of pension budget, and thus create the need for reforming the actual systems.

For example, reforming their social security systems is one of the most important structural problems facing both Germany and Japan, which are the second and third largest economies in the world. Both countries are experiencing a rapid aging of society, endangering the sustainability of their social insurance systems (see Bernd Hayo, Hiroyuki Ono, 2010). Supporting the idea, Most European countries have changed indexation rules, reduced early retirement options, increased retirement ages and encouraged the development of private pensions. Overall, they have reduced expenditure prospects significantly, thereby increasing again the risk of poverty (see Martin Kohli and Camila Arza, 2011)

Also, we analyze the impact of all these issues in the light of the global financial and economic crisis that commenced in mid-2007 and has significantly weakened countries' economies. In our opinion, it is very important to talk about general aspects of the crisis and its implications regarding pension funds. Looking ahead, the crisis, and the nature of policy responses to it, has highlighted the key role of social security institutions in realizing national social policy objectives. Social security institutions have an important role to play in any country and often occupy a special niche within governments. Their proximity to the general public

makes them an ideal vehicle for providing not only benefits but also services and information. Their databases can help policy-makers in the formulation of policy, informing them of what is possible. And social security institutions are the implementers of policy, determining whether the policy that is actually implemented is as intended or different.

Thus, there is much to be said for governments relying more on social security institutions in the formulation of policies, not least during a crisis. According to (ISSA, 2010), we present the following few statistics regarding the structure of population around the world:

2010	There are 740 million people aged 60 or older and forecasts show us that this will rise to 2billion by 2050;
2010	64 per cent of those aged 60 or older live in the less-developed regions and this percentage will rise to 79 by 2050;
2009	55 per cent of those aged 60 or older were women;
2010	There are 100 million people aged 80 or older around the world and this will rise to 400 million by 2050;
2009	Life expectancy at age 60 for Japanese women was an additional 22 years;
2009	The fertility rate in Germany was 1,3;

Due the fact that pension systems represent long-term commitments, governments need to adjust their policies in order to provide long-term stability. Governments who have relied on increasing productivity rate or on improving economic performance to restore the long-term sustainability of their pension budgets were affected negatively by the actual financial and economic crisis. The side effects of mid-2007 crisis are much more serious because economic recovery in the next few years is unlikely to compensate for all the financial losses and challenges caused by the demographic changes.

It is known that labour market conditions have a big impact on pensions and many pension systems would have healthier financial position if a larger proportion of working-age population were working and contributing. All these problems are correlated with unemployment rates, health problems of the population, lack of qualification, lack of mobility, etc. Public pension systems have undergone many structural changes over the past few years. There is concern about the equity of public pension budgets. Contribution rates can be raised in order to cover rising costs, benefits can be reduced in a more or less manner by altering

eligibility requirements or by changing the rules governing the indexation of pensions. Examination of the current demographic situation and its probable evolution indicates that pension systems are likely to remain in the centre of discussion. Many recent pension reforms were adopted in order to provide financial equilibrium, but were achieving this by reducing benefits. There is however a need to find an acceptable balance between the generosity of benefits and what the system can actually afford to provide.

3. Estimating the hypothetical level of contributions collected in the future

In order to estimate the hypothetical level of contributions collected in the future we analyze historical data from 1980 to 2009, after which we propose a forecasting model. However, we consider that using the historical level of social security contributions (as declared by each state's monitoring organization) would be a mistake, due to the complexity of elements which influence the statistic. First of all, we would need to deal with effective tax rates and tax systems, both elements endogenous to the government, and as such statistically unsterilized.

Secondly, there would also be issues with errors or reporting/registration omissions as well as possible changes in the economic behaviour of the entities who fund the government's efforts (be it individual contributors, companies, etc.). Since there is no perceivable way to actually model any such variations, we consider it acceptable to overlook them and proceed under the optimistic assumption that all participants to the economy fully and timely fulfil any official obligations. While optimistic, it is also worth mentioning that the countries under obligation are either highly developed (Germany, Japan, US) or under tight governmental control (Brazil, China). These elements make our analysis considerably more precise, as we can simply assume that no severe economic changes are likely in the future.

For these reasons, we will establish in the following paragraphs a more effective, albeit simple, system for assessing the hypothetical level of contributions, based on standard economic hypotheses and a modern analysis of the global status of government run social security programs.

First of all it is important to state that the countries analyzed in the following pages all use systems based on fixed mandatory tax rates established by law, which can however be supplemented (through voluntary contributions). As such, any approximation and analysis must be based on a fairly accurate evaluation of the tax base for said rates, for each country in particular. Based on the fact that monthly wages/income is usually considered the tax base, we believe that the product between the total economically active population and the average monthly wage in each nation represents an efficient approximation. Although there are lots of factors left out of the discussion, such as income earned by self-employed persons or from special types of income such as capital investments, overall the advantages of using such a clear-cut statistics outweigh the negative aspects. The hypothesis under which we build our model is that these statistics are correctly calculated by the national statistics institutes, and will not suffer great shocks in the medium run. It is common sense however to assume that the economically active population will not be greatly different from official predictions, since it is closely tied to very basic economic elements such as effective population growth and financial balance, which is expected to happen in the coming years (influencing the entire forecasted period). Further information regarding the procedures used in forecasting population levels can be obtained from the sources listed in the addendum. In the following we will consider these to be economically valid and accept them as valid data.

Since our interest lies in correctly forecasting the hypothetical level of contributions to be collected in the future, we see fit to choose the tax rate as being the one most stable towards the end of the analyzed period. The premise for such an approximation lies in the effective maturity of governments analyzed in this paper, which guarantees a high stability in legislation. Due to the fact that many social security systems have undergone strong reforms following the recent global financial crisis, we can assume that these systems will not receive major rectifications in the following years. Another strong point of this approach is that is more economically valid: all major analytical models function under the inherent assumption that economic parameters constantly tend to move towards their effective balance point (see Mankiw, 2002); in this sense it is more efficient to assume that a more recent tax rate will be closer to what governments determine to be the optimal rate. Even under the possibility

that the previous assumption will not be validated in the future, any changes are bound to be fairly small, as is the case with fiscal adjustments on a global scale.

The mechanism we use to evaluate the needed tax rate was to analyze the effective contributions tax rate which can be attributed to government reported earnings in the countries analyzed. As such, the model we use to determine the theoretical rate for contributions collectible in a year is as following:

$$SSTaxRate_t = CC_{et} / (Em.Pop. * Avg.Wage)_t$$

where:

$SSTaxRate_t$ – the tax rate for social security contributions in year t

CC_{et} – contributions collected in year t, relative to GDP

$Em.Pop.$ – total employed population in year t

$Avg.Wage$ – average wage in year t, relative to GDP

Results are presented in table 1 in the Addendum.

We then used data supplied by the International Social Security Association (ISSA) to correctly choose the tax rate we use for the forecast, so that it matches both fiscal and economic reality and recent reforms in each country's case. Therefore, we chose the rates presented in table 2 of the Addendum, by selecting a tax rate stability over at least the last 3 years of the analysis, with a variation of at most +/- 10% from the average. The only exception was Brazil, which is currently undergoing a series of reforms and adjustments, in which contributions' tax rates are altered on a year-to-year basis, in order to cope with the recent global economic crisis.

The differences between the official level of social security contributions and our results have a series of causes: rates of collection, system complexity (possible deductions for certain categories of income/people for example), as well as errors in recorded data. Given that these elements cannot be eliminated through conventional means, we decided to go around them and determine an effective economic tax rate, based on both econometric analysis and logical correlation with changes in the social security systems under observation. The forecast for the level

of contributions collected to the social security budget for the period 2010-2025, which is the frame for our analysis, was as modeled as a two-step process. First of all, we chose to forecast the elements with a relatively stable and linear economic trend such as average wages and pensions paid. As such, wages were predicted, based on historical data, using a Least Squares model, which was then adjusted by a 5-period moving average, in accordance to standard procedures of eliminating white-noise shocks. The results were then correlated with the number of predicted employees, as computed for the period 2010-2025 by the International Labour Organization (ILO-LABORSTA), in order to correctly evaluate this very important statistic containing many endogenous evolution variables (nativity, mortality, etc.). We then multiplied this by the SSTaxRate we obtained in the previous calculus and thus determined the forecast for contributions gathered for the social security budgets in 2010-2025, as following:

$$CC_t = (Em.Pop. * Avg.Wage)_t * SSTaxRate$$

where:

CC_t – contributions collected for the social security budgets, year t, relative to GDP

$Em.Pop.$ – total employed population, in year t

$Avg.Wage.$ – average wage, in year t, relative to GDP

$SSTaxRate$ – the tax rate for social security contributions, in year t, determined analytically

Results are presented in table 3 in the Addendum.

Some of the model's limitations are easily observable however, and can reduce its accuracy and prediction efficiency. First of all, since we considered the average wage as a proxy for the tax base and the number of employees as a proxy for total contributors, we overlook certain categories of people, such as those engaged in seasonal activities or liberal professions. We do however believe that their number and overall significance is small in this particular case, and that they counterbalance themselves income-wise, bringing the overall result closer to the effective mean.

Secondly, our model works under the effective assumption that no massive economic changes will occur during the period under analysis. It is obvious, looking at the dynamic IS-LM model detailed by Prof. Moisa Altar (2002), that both the average wages and the average level of pensions paid are closely intertwined and linked to the general economic trend identified through the GDP. As production in a country rises (in direct correlation with an increase in general demand), companies tend to divert more revenue towards increasing the quality and quantity of their operations, which also leads to an increase in wages. At the same time, the government registers higher income through taxes, and has more money to spend on pensions (which in most countries is considered a very good political tool).

While it is arguable that GDP can vary through time, especially in the case of developing countries like Brazil and China, our belief is that significant changes will not occur in the next couple of decades. From a historical perspective, it has usually taken centuries for most countries to settle from a growth period: the British Empire lasted for several centuries (up until this century's revolutions), the US established a hegemony in the 20th century, and even Japan was able to sustain a high growth rate for over 30 years (1950s-1980s) despite facing a huge economic crash in the 1980s. Due to these elements, we can assume that GDP, and consequentially the average wages level and the average paid pension, are fairly constant throughout at least a 15-year period as is the case with the current analysis.

4. Estimating the hypothetical level of pensions paid in the future

We used a model similar to the one used to forecast collected contributions, by which we determined based on historical data from the years 1980-2009, the values for the next 15 years. First we measured the average pension given to each retiree in the base period, as total government spending with old-age social security, divided by total number of retirees in each country (using data from their national statistics bureaus, correlated with the retirement age for each sex):

$$Avg. Pen. = \frac{SSGov.Exp.}{Retirees}$$

where:

Avg.Pen. – average pension received by every beneficiary, as % of GDP

SSGov.Exp. – Government expenditure with social security, as % of GDP

Retirees – number of retirees, total

Results are presented in table 4 in the Addendum.

We kept the data in the percentage-of-GDP format for ease of analysis, in order to correctly and efficiently correlate data and results. Using the previous model we established what the average relative to GDP pensions are for each country, an estimator for the general social development level and the effectiveness of the social security system. The forecast for 2010-2025 was done similarly to the one for contributions collected, using a Least Squares model, adjusted by a 5-period moving average. This procedure is efficient due to the pensions' characteristic of having an evolution relatively close to national GDP growth levels, varying slightly based on long and very-long term government strategy. Thus, a simple model is sufficient to predict a general trend in pensions.

Forecasting the predicted level of government spending with social security was done purely economically, using a reverse function from the previous one. We chose to separate the calculus this way in order to take advantage of official estimations for the number of future retirees made by each country's national statistics bureau with complex data.

Given that all countries in the current study are either highly developed countries (US, Japan, Germany) which have very small population variation levels, or countries which have a small historical population variation level in recent years (Brazil, China – mostly due to specific regulation), we believe that official estimations will be fairly accurate.

Similarly to the previous point, these predictions include complex analysis about future population prospects. As such, our model is as following:

$$SSGov.Exp. = \frac{Avg.Pen.}{Retirees}$$

Results are presented in table 5 in the Addendum.

Some problems related to data cohesion appear in this case: within our model we presume that, overall, all retirees are under the same pension-plan, without regard to time-frame of region. Although this is true for the US and Germany, the other three countries manifest small irregularities, which will be discussed in depth in the following pages, since our belief is that they are in fact already inherently integrated in our model.

Another issue brought into light in recent years is the possibility of strong reform, or even of revolution in developing countries (such as Brazil or China). While the events from the Middle East combined with the general status of the global economy, which at the time of this paper is still in recession, do open up the possibility of a very complex change in political status within the analyzed period, we believe that such events are clearly unforeseeable and impossible to implement in a coherent model. Such issues are, as such, accepted and treated as a weakness of the model.

5. The description of the social security systems under study

The United States of America

In the current paper our aim is to study both old and new strategies for social security systems, in some of the most influential countries in the world. As such, we considered relevant to perform a complete analysis on the pension systems in the US, China, Japan, Germany and Brazil. In accordance with the Social Security Programs Throughout the World (2010), the United States of America, the first and current law about old-age, disability, and survivors was applied in 1935, with amendments. The insured are employed persons, including self-employed persons. There also is voluntary coverage for employees of state and local governments, not covered under a retirement system. There are certain exclusions applied for casual agricultural, household, and elected employees, some

categories of self-employed persons when their annual income is below \$400.

It is required that each employed or self-employed person pay a monthly amount to the social security budget. The contributions paid by each person depend on their monthly income. In accordance to different categories of insured persons there are many levels of contributions, as follows:

- 6,2% of covered earnings – applied for insured persons;
- 12,4% of covered earnings – applied for self-employed persons;
- 6,2% of covered payroll – applied for employers;
- The total cost of means-tested supplemental income benefits – supported by the Government;

The full retirement age required for workers retiring in 2009 is age 66, and it is expected to increase gradually to age 67 by 2027. There are some exceptions when the United States government can accept to pay an early pension starting with the age 62. In this case, the benefits are reduced proportionally with the reduced years of contribution. Also, the pension may be deferred up to age 70, but no more than this age. For those people aged 65 or older, with a low income and limited resources, some benefits are paid by the government through the social security budget.

The United States government comes to help different categories of persons by offering a disability pension. In this case, the insured must be assessed as incapable of substantial gainful activity. This category includes: persons who suffer of a physical or mental impairment that is expected to last at least a year, blind people, etc. A disability supplemental income benefit is paid to persons with a disability and blind persons younger than age 65 with a low income and limited resources. In accordance to economic theory and to our own approximations, after the examination of social security contributions, we obtained a very relevant value of 12.6 per cent, stable over the last 20 years. Next, we compared this value with the real one (12.4 per cent) and noticed that the two of them are reasonably close. One of the reasons the two values are similar is the lack of reforms (the last social security reform being implemented in 1991). Another explanation would be the general nature of contributions and the lack of complexity in the system. There are neither lump-sum

settlements nor many groups of insured persons under some special conditions of application.

China

In China, the regulatory framework for old-age, disability, and survivors pension presented by the Social Security Programs Throughout the World (2010), had its first law in 1951. In contrast to the social security system applied in the US, China has seen lots of reforms recently, aimed at ensuring the sustainability of the budget while also increasing coverage. The country's first national law on social insurance was adopted in October 2010 and will be implemented in July 2011. The new law mainly unifies existing social security schemes. The Chinese government developed a social security system to collect contributions and pay benefits depending on the different regions where insured persons live (urban or rural areas). Pilot rural pension schemes are gradually being rolled out in the form of social assistance and individual accounts. Talking about social security budget requires knowing the sources of funds, learning some basic implications and understanding its limitations.

The structure of contributions is as follows:

- 8% of gross insured earnings – for insured persons;
- 8% of the local average wage – for self-employed persons;
- Central and local government provide subsidies as needed to the individual accounts of insured persons;

The retirement age required for workers depends on different categories of qualification for both men and women. For men and professional women the retirement required age is age 60. The retirement required age declines gradually depending on some categories of working women, from age 60 to age 55 for non-professional women, or age 50 for other categories of women. There are several exclusions regarding the retirement required age for those insured persons who work under certain arduous or unhealthy environments. For men the retirement required age is age 55 and for women this age declines to age 45. The insured must have at least 15 years of coverage. A lump-sum is paid of the balance of the insured's total contributions plus interest.

Estimating the contributions paid by the insured persons to the social security budget, we obtained the value of 1.55 per cent, far below the official value of 8 per cent. On the one hand, the most likely cause why

the difference between the two values is so high is that public data on China is both scarce and sometimes untrustworthy. On the other hand, the issues are caused by probable high levels of corruption and biased statistics institutions. All these problems can lead to a low level of tax collection, or several types of errors in data selection. In order to avoid this sensitive subject, we focus on the analysis of the reforms implemented in the last six years, as most of the major reforms were applied in the period between 2002 and 2006, and of course the new set of challenges arising in the years ahead.

Japan

In accordance with the Social Security Programs Throughout the World (2010), in Japan the first law about social security system was implemented in 1941. The current laws for both employees' pension insurance and national pension were implemented in 1954, respectively 1959. Different from other systems, the Japanese social security system involves a flat-rate benefit for all residents under national pension program and earnings-related benefits under the employees' pension insurance program or other employment-related program. The Japanese social security system involves two different pension programs, National pension program, respectively Employees' pension insurance.

The coverage systems adopted by the government, are organized as follow:

- In accordance to the National pension program, the persons in right to benefit of coverage are the persons residing in Japan aged 20 to 59; there also is a voluntary coverage for persons residing in Japan aged 60 to 64;
- The employees' pension insurance offers coverage for employees younger than age 70 in covered firms in industry and commerce, including seamen. There are certain exclusions for most self-employed persons. For civil servants, the pension program is working under a special employment-related system.

The sources of funds are established following the same pension programs' classification:

- In accordance to the National pension program, the budget is based on contributions transferred from the employees' pension insurance or other employment-related program. The total

amount transferred is based on the number of insured persons under each program. The persons who registered low income, those who receive benefits from the disability national pension program, and persons who receive livelihood assistance can choose to not contribute to the social security budget. Self-employed people contribute 15100 yen a month (applied from April 2010 to March 2011). The government also covers 50 per cent of benefits and 100 per cent of administrative costs through the national tax system.

- The source of funds for employees' pension insurance is based on the different amounts established in accordance to the numerous categories of insured persons, as follows: 7.852 per cent of monthly wage class earnings (salary and bonuses before tax), according to 30 wage classes; 8.224 per cent of monthly earnings (salary and bonuses before tax) applied to miners and seamen; employers contribute 5.47 per cent to 5.77 per cent of monthly payroll; the Government finances the total cost of administration from the national tax system.

In accordance to the social security system, and National pension program, the full retirement age required for workers is age 65 with at least 25 years of contributions. A full pension is paid with 40 years of paid contributions. Under certain special conditions, the Japanese government can pay an early pension for those people older than age 60 and younger than age 64, who registered 40 years of paid contributions.

Concerning to the employees' pension insurance, the full retirement age is age 60 (age 59 required for miners and seamen) with at least 25 years of contributions. If a person who achieves the age required for retirement (age 60) wants to remain employed, will benefit of both pension and wage as long as the sum of both amounts will not overcome a certain limit amount established through law. In opposite, the government will pay a reduced pension. The reduction amount is bigger for persons aged between ages 60 and 64 than for those aged between ages 65 and 69. The full retirement age required for each Japanese employee will increase gradually from age 60 to age 65 by 2025 (applied for men), and by 2030 (applied for women).

After a careful analysis of the data, we obtained a monthly rate of 18.9 per cent applied to the entire income, representing the contributions

paid to the social security budget. Having a special social security system based on two different categories of mandatory dues, the Japanese system requires some more careful discussions. The real value of contribution calculated in accordance with the current law would theoretically be equal to the sum of 7.85 per cent divided by 0.635 (since 36.5 per cent from the total costs are supported by the government) and 7.675 per cent. The total amount is about 20 per cent, relatively close to the value obtained by our calculations (18.7 per cent). It is important to take into account that the Japanese social security system is a very complex system, based on exclusions and special policies, and that is why we should not overlook possible fluctuations of the obtained data. The stability of contributions is based on observed data over the past 8 years, despite the large number of reforms implemented in this period (the most significant impact of these reforms will probably be seen in the near future: 2012-2013, depending on the following economic events).

Germany

In regard to the regulatory framework developed by the Social Security Programs Throughout the World (2010), in Germany the first law about old-age and disability was adopted in 1889, and implemented in 1891; the law about survivors was proposed later, in 1911, and implemented in 1914. The German government adopted many different reforms through time, trying to find the best policies for both people and social security budget. As such, the current law about pension insurance was implemented less than 10 years ago, in 2002. Concerning the current social security system, the ones covered are employed persons (including apprentices), certain self-employed persons, persons caring for a child younger than age 3, recipients of social security benefits (such as unemployment benefits), conscripts or persons doing community service instead military service, and also voluntary care workers. A voluntary coverage is offered for people aged 16 or older who are exempt from compulsory coverage. For certain self-employed persons, miners, public-sector employees, civil servants, and farmers, the German government has a special system in place.

The rates of contribution that actually represent the source of funds for the social security budget are established, in accordance to the current law, as follows:

- 9.95 per cent of monthly earnings – for insured persons. No contribution if earnings are less than 400 euro a month (voluntary contribution can be made), and a reduce contribution is paid if monthly earnings are from 401 euro to 800 euro;
- 19.9 per cent of monthly income – for self-employed persons;
- 9.95 per cent of monthly payrolls – for employers;

The full retirement age required for German workers is age 65 with at least 5 years of contributions. For those persons born after 1964, the pensionable age is 67, and for those born before 1965, the normal pensionable age will rise gradually from age 65 to age 67 with at least 5 years contributions from 2012 to 2029.

In Germany, the situation of the social security system is very good. The system is very healthy and well managed since the last significant pension reform (2000). The value of 28.3 per cent, representing the contribution amount, is based on voluntary contributions. People choose to contribute with a rate of their monthly income over the minimum rate, established by the government through the social security system.

The actual system applied in Germany is very profitable given its high complexity and the relatively high amounts of voluntary contributions. People also have high confidence in the German government. This is one of the reasons why the social security budget recorded surplus in the past few years.

Brazil

In accordance to the regulatory framework presented by the Social Security Programs Throughout the World (2010), in Brazil the current law was implemented in 1991. The recipients of pension coverage are employed persons in industry, commerce, and agriculture; rural workers; household workers; some categories of casual workers; elected civil servants; and self-employed persons. Voluntary coverage for students, housewives, unemployed persons, and other categories also exists. There is a special system in place for public-sector employees and military personnel.

The source of funds is based on the following rates of contribution:

- 8 per cent of covered earnings with monthly earnings up to 965.67 reais; 9 per cent with earnings from 965.68 reais to

1,609.45 reais; or 11 per cent with earnings from 1,609.46 reais to 3,218.90 reais;

- 20 per cent of declared earnings for self-employed persons; a reduced contribution of 11 per cent of minimum monthly salary finances for reduced benefits;
- 20 per cent of covered payroll for employers;
- Funds from other taxes are used by the government to finance administrative costs and any deficit.

The full retirement age required for Brazilian workers is age 65 applied for men, respectively age 60 applied for women, if both of them are working in urban areas. For those who work in the rural regions, the full retirement age is age 60 (men), and age 55 (women). This classification is available for both employed and self-employed people.

For Brazil, the analysis proved rather difficult. We have used the value of 9.3 per cent of monthly income to calculate contributions. The main issue comes from many parts: first of all, the instability of this rate over time (this value was relatively stable only in the past 3 years), and the lack of relevance (the rate of 9.3 per cent is relevant only if it is applied to the individuals' monthly earnings). This situation is a result of the system's instability and many unprofitable reforms. At the same time, the Brazilian government seems to be oriented to social equilibrium, which leads us to hope for stable rates of contribution, and also for a sustainable social security system in general.

6. Backtracked analysis of the Pay-as-you-go (PAYG) system

As we have already mentioned above, the main issue which governments from any country have to deal with is the ageing process. Our results clearly show us that populations ageing rapidly due to rising life expectancy and declining fertility rates have a considerable impact on budgetary elements relating to the social security system. This is not the only problem which countries need to be aware with, we have also to take into account all the difficulties encountered by extended families and other ways of supporting the elderly which are already weakening under the pressure of urbanization and globalization.

Given that all these events cannot be avoided, governments must find active solutions to implement new strategies according to the need for reform. Old-age benefits in most countries are wage-related, periodic payments. Some countries pay a universal fixed amount that bears no relationship to prior earnings; others supplement their universal or mandatory pension with earnings-related pensions. There are two different types of financing systems that are generally used for social security programs: defined-contribution (DC), and defined-benefit (DB). Several recent studies have examined the benefits or the issues brought by both the DC, and DB. James Poterba, Joshua Rauh, Steven Venti, and David Wise(2007) made a comparison between the two programs, on the United States' pension structure, and concluded that the DC plans are expanding rapidly given the fact that many people from the US, and not only, choose to have their pensions covered under this social security program, even if in the past decades the social security system has been dominated by DB plans.

For example, China has created a mixed social security pension system with a defined benefit PAYG portion and an investment-based defined contribution portion. Many researchers analyzed the economics of these two types of systems in the Chinese context and found advantages to China's creation of an investment-based portion (see Feldstein Martin, 1999). Defined-contribution accounts are similar to pension offered by private employers, individuals contribute to their accounts and receive payments from their own accounts when they are eligible for benefits. A competing system is the defined-benefit, or Pay-As-You-Go (PAYG) system, which exist in all the countries analyzed in our paper. This system consists of a benefit amount defined by the government and which in many systems, bears little relation to the amount actually contributed by the individual. Benefits paid to retirees are contributed by workers paying into the system currently. The amount paid in by current workers in a given year is supposed to equal the amount being paid out to retirees in that year (Martin Feldstein and Jeffrey B. Liebman, 2002). However, this setup is highly vulnerable to changes in demographics and socio-economic imbalances that may occur in a given period.

Many countries have problems with their PAYG system. For example, Japan's public pension system is essentially a pay-as-you-go system that is fraught with problems. It has an adverse impact on the inter-

and intra-generational allocation of resources, and it discourages private saving as well as the labour supply of the aged and of women. Moreover, many of these problems can be expected to become even more serious as the aging of the population proceeds at an accelerating pace. The United States, Germany, and many other developed countries not only have pay-as-you-go public pension systems that are very similar to Japan's but also face very similar demographic trends (see Charles Yuji Horioka, 1999). One concern is population ageing: In many industrialized countries, relatively more people are retiring and drawing benefits and fewer workers are paying into the system. For example, when social security began in the United States in 1935 there were 45 people paying into the system for every retiree. Today the ratio is approximately 3 to 1 (Social Security Systems Around the World, 2009).

Time has shown that social security programs are extremely important all over the world, and regardless of the policy promoted, the pension systems will always be in the attention of governments. Despite the fact that some systems are relatively new, while others long-established, all are embedded in economic and demographic realities about whom cares for the elderly; our purpose is to understand the systems developed by governments from the five countries previously mentioned, and analyze the budgetary implications of their current status, as well as future trends in their status. In order to achieve our aims of identifying if these pension systems are able to ensure sustainability over at least fifteen years from now, we will start with an analysis which will allow us to observe the trend of social security budgets since 1980.

7. Budgetary impact of the model

Taking into account the results from Table 6, we can conclude that from all five countries which were analyzed in our paper, Brazil, China, and Japan have faced many problems in terms of social security budget. On the other hand, when we applied the forecast function on the recorded data in order to take the trend followed by the social security budget to the future (from 2010 to 2025), we observed that in Japan, the situation is extremely difficult due to the ageing population. In accordance to our results, the problem of the increasing number of old-age people is felt

stronger in Japan than in China, and will increase gradually until 2025. This comes as no surprise if we take a look at long term development in these two countries: Japan's "golden years" of economic prosperity were in the 1950-1970 period, while the Chinese economy is currently in the middle of its industrialized boom and is rapidly rising to become one of the most important forces in modern times. While the issue of correlation between population age-pyramid shape and economic growth is not treated in this paper, it remains in our eyes as an important premise for future studies. We can however, based on results presented, presume a priori that a country with powerful growth patterns usually requires a young workforce (and a young population) to help sustain it. As such, any country with a strong economic development period would need to "cool off" afterwards, as very strong rises in population are economically unsustainable; this would in turn lead to a larger number of old people (retirees, 50 years plus) as compared to the general population. This is what we believe Japan is currently facing, and what China should expect in a few decades.

Despite dealing with many problems, China's social security budget presents a better economic situation than the social security budget of Japan. In China, the problems regarding the ageing population are relatively lower than in Japan, and thus the social security budget shows a lower deficit with less of a downward trend. In accordance to our estimations Japan's deficit will go from bad to worse, from a value of 0.5 per cent of GDP by 2010 to a value fifteen times bigger, by 2025. At the same time, China's social security budget deficit was estimated at approximately 1.18 per cent of China's GDP by 2010, and the forecast shows that it will increase six times by 2025. We could however say that China's social security costs will be covered by economic growth. Due to the fact that the revenue will be not sufficient to cover expenditure, Japan's government should implement reforms in order to ensure the sustainability of its social security budget.

There is however no doubt that Brazil is the country with the worst budgetary situation. After a careful analysis, we can say that Brazil is also the worst performer due to the fact that it will lose more than 100 per cent of its annual GDP in the entirety of the forecasted period. While forecast results may look grim, we need to remind ourselves that Brazil presents a special case, being in the process of a massive restructuring and

rethinking of the social security systems. Our data shows that budgetary revenues have fluctuated considerably over the past 30 years (doubling over the first part, then halving in the other), while expenditure has seen constant growth (being closely related to population growth patterns). The modeled economic-contributions' rate is also unstable, having seen a sharp rise in the last 5-6 years, mostly due to changes in the system's characteristics. The sheer speed and amplitude of these modifications come as a testimony of the impact that serious reforms can have on budgetary prospects.

The United States' economic situation seems to be relatively stable, for at least three years from now on. Based on historical data, we observed that since 2013 the trend goes down. However, the results show that the economic situation of the US social security budget will decrease gradually in the following decades; the budget moving from surplus to deficit. Germany proved to be the only country from all the five countries with an efficient social security system over time. According to our forecast, the German social security budget will succeed to collect enough contributions to cover all the related expenditures. Over the entire period analyzed, Germany will probably be able to record a surplus by almost 40 per cent of annual GDP, which would in fact be a considerable amount.

Observing the promising results recorded by Germany, we decided to take a closer look at its social security system, making a deeper analysis on all the reforms implemented by the government from 1980 to 2009. As such, we noticed that the policies adopted by the German government were able to ensure the long-term sustainability of the pension budget. Having a well managed system, the social security budget will be able to remain stable in time. The budget will record a surplus by 1.5% to 5% over the following 10 years. This surplus can be used to cover the deficits that can be recorded over the next decades.

However, Brazil, China, Japan, and United States are the countries who will face large financing needs outside their social security budgets and requiring additional funds: between 9 and 25 per cent of budgetary revenues needed to cover the Brazil's deficit, between 6 and 20 per cent in case of China, between 2 and 22 per cent in case of Japan, and between 2 and 9 per cent for United States (Table 7). It is important to mention that these estimations were based on a linear evolution of government revenues, which implies only a cyclical effective variation, with

little structural change. Any changes brought to the fiscal system in each state would generate errors, and concerning countries with a high rate of reforms brought to the social security system (as is the case with Brazil and China) the results cannot be considered relevant over a medium and long time horizon. Nevertheless, since our aim is to only offer an overview of the current budgetary status, the models we propose are sufficiently accurate.

Conclusions

There is a pressing need for change in the social security systems of many countries, even the ones who are considered to be highly developed, else risking a growing budgetary deficit which could in the end lead to debt meltdowns similar to those seen in the past years in Europe. While the current study only takes a simplified look at the situation of the social security budgets in 5 great global economies (Brazil, China, Germany, Japan and the US), our model presents a cohesive economic concept of the way social security budgets will evolve under current conditions. Since we have chosen to rely on global specialists' data for complex forecasts on population changes and economic prospects, and focused our attention on designing a clear economic model applied to a solid data selection, we can only offer insight into the general trend and situation of the budget.



As our analysis is on the effects that an ageing population on social security budget, we have focused on old-age benefits, and have tailored the available data in order to more correctly compute the results. Thus, we have found that countries relying on the standard PAYG system with most of the funds coming from mandatory contributions need to find a complex economic balance between current revenue and expenses, in order to avoid creating a deficit. This is achieved in the countries under observation by constant reforms (one every 20-30 years) and adjustments in the form of budgetary transfers. While some have adapted better over the years (Germany, US), some are still trying to define a system that works under their particular conditions (Brazil).

We have also noticed that countries with a very prominent growth pattern in the past (such as Japan, and soon China) tend to suffer







considerably when their “economic steam” is expended, as new generations have to use the achieved development status to cover expenses for both themselves and their elders, who now rely of the pension system for subsistence. If the situations not controlled, the budgetary deficit thus created threatens to put additional pressure on further generations, and might act as an economic break to growth.

In conclusion, we believe that there is a need for a design change in the social security systems used throughout the world. While Germany did outperform its peers, achieving budgetary equilibrium, this was done by implementing a very complex system with greatly varying rates and conditions for contributions, and considering a high rate of voluntary contributions to the state pension system (a rarity even in very developed countries). The answer will not come easily to governments, but the need for change is starting to be felt stronger and stronger as deficits in the social security budgets start to rise.

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Contributions' rate	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Brazil											0.045459	0.032278	0.037647	0.040411	0.038519	0.050923
China	0.01239781					0.025994					0.014204	0.013578	0.012996	0.013208	0.011513	0.01129
Germany	0.18189218						0.214978			0.214436	0.215832	0.268585	0.269145	0.27153	0.285429	0.287959
Japan	0.11678097	0.123134	0.12621	0.127211	0.128514	0.137911	0.140388	0.141569	0.145674	0.148765	0.140534	0.14172	0.142452	0.14539	0.148574	0.159174
US	0.08511482	0.089989	0.085318	0.082937	0.088103	0.104456	0.107601	0.109798	0.115295	0.117468	0.125313	0.126825	0.127444	0.127383	0.128955	0.127941

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
	0.060426	0.060513	0.066709	0.043787	0.054639	0.044033	0.039523	0.039739	0.041682	0.056775	0.071275	0.08667	0.106366	0.110601
	0.011296	0.012759	0.012273	0.01255	0.013038	0.013494	0.013478	0.013569	0.014419	0.015045	0.015293	0.016596	0.016436	
	0.290794	0.299813	0.29933	0.292222	0.291766	0.287272	0.286799	0.28974	0.292481	0.279994	0.275963	0.268026	0.276985	0.277613
	0.162276	0.163939	0.16422	0.164501	0.167198	0.173759	0.180308	0.181183	0.183725	0.185903	0.190415	0.194416	0.195513	
	0.126968	0.126123	0.124961	0.124088	0.125071	0.126827	0.126861	0.127086	0.128245	0.127916	0.12673	0.124888	0.126331	0.122098

Source: own estimations based on data from the OECD, CEPALSTAT, ADB SDBS, LABORSTA, IGBE

Table 1. Tax rate of contributions to the social security budget

Contributions' rate	(adjusted average)
Brazil	9.373%
China	1.556%
Germany	28.353%
Japan	18.735%
US	12.646%

Source: own estimations based on data from the OECD, CEPALSTAT, ADB SDBS, LABORSTA, IGBE

Table 2. Tax rate of contributions-adjusted

Forecast of revenues (% of GDP)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Brazil	0.09679802	0.098427	0.10323	0.110667	0.117044	0.113568	0.10993	0.10613	0.102163	0.098019	0.093697	0.089758	0.085385	0.080886	0.07626	0.071509
China	0.01105768	0.010436	0.009836	0.009178	0.009084	0.00885	0.008605	0.008351	0.008088	0.007821	0.007551	0.007356	0.00711	0.006862	0.006613	0.006363
Germany	0.14306391	0.140925	0.139004	0.136651	0.132869	0.130916	0.128803	0.126545	0.124163	0.121675	0.119106	0.118177	0.116212	0.114255	0.112305	0.110363
Japan	0.09823641	0.095862	0.093717	0.090814	0.086915	0.085279	0.083709	0.082197	0.08073	0.079291	0.07786	0.076114	0.0746	0.073098	0.071608	0.070132
US	0.06448777	0.062478	0.060106	0.057232	0.053624	0.051914	0.050154	0.048346	0.046495	0.044604	0.042679	0.040809	0.038934	0.036968	0.034971	0.032943

Source: own estimations based on data from the OECD, CEPALSTAT, ADB SDBS, LABORSTA, IGBE

Table 3. Social security budget revenues .Forecast from 2010 to 2025

Average pension (1 in 1 billion of GDP per person)	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Brazil	9.286423167	8.784286177	9.47045743	9.078327607	8.553520621	8.139120646	8.76735074	7.956807965	7.912771738	7.866917229	7.973599081	7.82777118	7.741989004	
China														
Germany	10.146582	10.32025	10.6804	10.9804	10.9122	10.97216	10.79206	10.49903	10.32128	10.00314	9.703696656	4.275712	4.362771499	4.502288018
Japan	2.838637	2.97393	3.094853	3.139136	3.1181	3.091725	3.214432	3.14067	2.983894	2.863233	2.738478028	2.665255	2.70410048	2.75131649
US	1.4624775	1.497532	1.548931	1.508065	1.423728	1.353164	1.333954	1.296007	1.281441	1.247674	1.233557709	1.262573438	1.255034579	1.272811073

1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
9.286423167	8.784286177	9.47045743	9.078327607	8.553520621	8.139120646	8.76735074	7.956807965	7.912771738	7.866917229	7.973599081	7.82777118	7.741989004	
0.015528749	0.015136209	0.03120049	0.07202404	0.058564663	0.09356237	0.114079981	0.095192783	0.083276581	0.095378861	0.094369405	0.133899449	0.136945302	0.159184309
4.748509948	4.731535944	4.71793857	4.647670763	4.588117023	4.546329303	4.566652942	4.595796686	4.52506738	4.493618735	4.359297131	4.184329281	4.190514315	4.394761022
2.861124257	2.866325859	2.92534257	2.999150382	3.144594165	3.237416364	3.328536967	3.355132268	3.370316771	3.346014985	3.250263118	3.199461113	3.443210455	3.879956315
1.194739215	1.179707903	1.15384615	1.117362744	1.105615066	1.107241868	1.120767678	1.104676455	1.079735442	1.056261695	1.035890151	1.013267013	1.010711795	1.048973095

2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
7.636475	7.5448074	7.4531398	7.3614723	7.2698047	7.1781372	7.0864696	6.994802	6.9031345	6.8114669	6.7197993	6.6281318	6.5364642	6.4447967	6.3531291	6.2614615
0.1433998	0.1506324	0.1578649	0.1650975	0.17233	0.1795626	0.1867952	0.1940277	0.2012603	0.2084928	0.2157254	0.2229558	0.2301905	0.2374231	0.2446556	0.2518882
4.4028245	4.3925018	4.3821791	4.3718564	4.3615337	4.351211	4.3408883	4.3305656	4.3202429	4.3099202	4.2995975	4.2892748	4.2789521	4.2686293	4.2583066	4.2479839
3.334117	3.3508851	3.3676532	3.3844212	3.4011893	3.4179574	3.4347255	3.4514936	3.4682617	3.4850297	3.5017978	3.5185659	3.535334	3.5521021	3.5688701	3.5856382
0.9662942	0.9495837	0.9328732	0.9161626	0.8994521	0.8827416	0.8660311	0.8493205	0.83261	0.8158995	0.799189	0.7824784	0.7657679	0.7490574	0.7323469	0.7156363

Source: own estimations based on data from the OECD, CEPALSTAT, ADB SDBS, LABORSTA, IGBE

Table 4. Average pension

Forecast pension expenditure (% of GDP)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Brazil	0.1300461	0.13317	0.136662	0.140754	0.144913	0.148816	0.15281	0.156889	0.161052	0.165793	0.16967439	0.173982	0.178403751	0.182855567	0.187376463	0.191807943
China	0.0278453	0.025693	0.027777	0.030107	0.032037	0.035098	0.037901	0.041041	0.044285	0.046787	0.04934351	0.051315	0.054157526	0.059240975	0.064119463	0.068957335
Germany	0.0917533	0.093007	0.094965	0.096866	0.097833	0.09876	0.099749	0.100827	0.101958	0.103211	0.10461714	0.106117	0.107685763	0.109344198	0.111063743	0.112692353
Japan	0.1035151	0.107456	0.111655	0.114388	0.113365	0.11539	0.119233	0.123924	0.128625	0.132892	0.13693949	0.13897	0.141381683	0.143326621	0.145072769	0.146563276
US	0.0578428	0.058417	0.059097	0.059628	0.059467	0.06019	0.060823	0.061455	0.062063	0.062579	0.06312931	0.063504	0.063758437	0.063904644	0.063993282	0.063887956

Source: own estimations based on data from the OECD, CEPALSTAT, ADB SDBS, LABORSTA, IGBE

Table 5. Social security budget expenditures. Forecast from 2010 to 2025

Pension deficit (% of GDP)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Brazil	-0.03325	-0.03474	-0.03343	-0.02959	-0.02787	-0.03525	-0.04288	-0.05076	-0.05889	-0.06727	-0.07591	-0.08422	-0.09302	-0.10197	-0.11107	-0.12029
China	-0.01179	-0.01526	-0.01794	-0.02093	-0.02295	-0.02625	-0.02938	-0.03269	-0.0362	-0.03897	-0.04176	-0.04396	-0.04705	-0.05238	-0.05751	-0.06259
Germany	0.051311	0.047917	0.044119	0.039785	0.035036	0.032156	0.029054	0.025718	0.022204	0.018464	0.014489	0.01206	0.008527	0.004911	0.001241	-0.00233
Japan	-0.00528	-0.01159	-0.01794	-0.02357	-0.02645	-0.03011	-0.03552	-0.04173	-0.0479	-0.0534	-0.05823	-0.06286	-0.06678	-0.07023	-0.07346	-0.07643
US	0.006645	0.004062	0.001009	-0.0024	-0.00584	-0.00828	-0.01067	-0.01311	-0.01557	-0.01797	-0.02044	-0.02264	-0.02482	-0.02694	-0.02899	-0.03094

Source: own estimations based on data from the OECD, CEPALSTAT, ADB SDBS, LABORSTA, IGBE

Table 6. Pension Deficit/Surplus

