The Long Term Effects of Federal Government Debt Accumulation on Employment in the United States of America

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Resumen

A pesar de los beneficios financieros de la deuda pública, su eficacia en la economía y los mecanismos de transmisión de la política fiscal están todavía en debate. Ante esta situación, el objetivo general de este artículo de investigación fue evaluar empíricamente sus efectos en la demanda laboral. Se parte de que la deuda cambia el valor de la moneda, lo cual genera fluctuaciones en los precios, tanto de la producción como de la mano de obra, de esta manera se plantea la hipótesis que al haber un aumento en la deuda acumulada, más mano de obra es empleada en la economía–conforme la moneda se deprecia. En el período 1973-2010 y utilizando métodos econométricos de series de tiempo, se determinó que —en los Estados Unidos de América— a largo plazo, la acumulación de deuda pública hace que la cantidad de mano de obra empleada en la economía sea alterada significativamente.

Palabras clave: política fiscal, finanzas públicas, deuda federal, empleo

Abstract

Despite the financial benefits of government debt, its effectiveness in the economy and the transmission mechanisms of fiscal policy are still on debate. Given this situation, the general goal of this research article was to empirically assess the effects of debt on labor demand. By assuming that debt changes the foreign exchange value of the currency, and that these deviations in the underlying value of money generate price fluctuations of both output and labor, it was hypothesized that when there is an increase in the stock of accumulated debt, more labor is employed in the economy as the currency depreciates. For the period 1973-2010, using time series econometric

Fecha de recepción: 6 de julio de 2015; Fecha de aceptación: 28 de julio de 2015.

methods, it was determined that– in The United States of America–the employed labor of the economy is, in the long run, significantly altered by government debt accumulation.

Keywords: fiscal policy, public finance, federal debt, employment
JEL Classification: E62, J23, H30, G18

Introduction

The United States of America is increasingly relying on government debt to promote growth in employment and to position the economy out of a recessionary path. The administration lead by President Barack Hussein Obama has sponsored new bills such as the 2009 American Recovery and Reinvestment Act that will make the economy more dependent on government spending; sharing similar goals with the previous administration that enacted the 2008 Emergency Economic Stabilization Act, the 2008 Economic Stimulus Act, the 2003 Medicare Prescription Drug, Improvement, and Modernization Act. In addition to the wars in Iraq and Afghanistan, these acts have fostered the greatest expansion of the United States federal government in the new millennium, making the economy more reliant on government spending and much less supported on free markets.

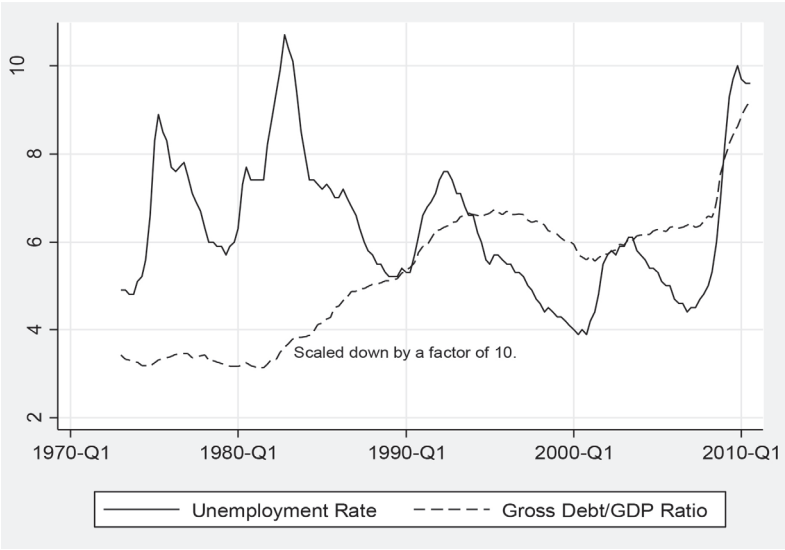
The enacted laws have increased the dependence on debt; but at the same time, the economic stimulus act also cuts taxes, continuing the practice of lower taxation that was institutionalized by Ronald Reagan (Economic Recovery Tax Act, 1981) which was followed by President George W. Bush (Economic Growth and Tax Relief Reconciliation Act, 2001; Job Creation and Worker Assistance Act, 2002; Jobs and Growth Tax Relief Reconciliation Act, 2003). These policies, together with the last recession (2007-2009) and spending on the global wars "on terror", have exacerbated both fiscal deficits and the accumulated debts by the federal United States government.

The reliance on debt by the United States government to expand the economy can be observed in the evolving gross debt to GDP ratios, figure 1, which have changed from 32% in 1980 to 69% by 2008 (ratios in the figure were scaled down by a factor of 10 for facilitating associations and comparisons). Evidently, this ratio has constantly increased in the period 1980-1992. Thereafter, however, it should be pointed out that the ratio decreased from 66% in 1993 to 56% in 2001. Since then, the reliance on government debt has gradually increased, and by the third quarter of 2010 the aforementioned ratio reached 92%. In sum, the quarterly growth rate of the debt/GDP ratio was .56% in the 1980-2008 period versus 2.5% in the 2009:1-2010:3 period. Furthermore, a closer inspection of figure 1 shows those periods of rising unemployment rate (peaks can be noticed in the years 1975, 1982, 1992, 2003 and 2009) had been accompanied, for the most part, with more reliance on government debt as measured by the gross debt/GDP ratio.

This empirical observation leads me to question whether government debt is effectively increasing the demanded for labor in the economy. And given the current debate on the efficacy of government debt to restore growth in the United States eco-

nomy as well as the biased enacted laws towards debt accumulation, it is necessary to increase our understanding about its long term economic effects; and thus, uncovering the effect on employment demand is the focus of study of this research. Based on theoretical and empirical assumptions, an employment demand function is estimated, using dynamic econometric models with the sole objective of understanding how the effects of government debt are impacting labor markets in the long run. Next, the theoretical fundamentals underlying the estimation of parameters are described.

Figure 1
Unemployment rate and gross government debt/GDP ratio for the United States



Source: By author with data from Bureau of Labor Statistics and Federal Reserve Bank of St. Louis.

Note: The ratios of government debt to GDP were scaled down by a factor of 10 for facilitating associations and comparisons with the unemployment percentage rate.

Theoretical background

Movements in real exchange rates cause adjustments on the labor demand function due to the effects on profits, especially in those firms with high share of revenue originated from either exports or high costs of imported production inputs. Consequently, changes in the real exchange rate would alter relative prices and will eventually have effects on job creation and job reduction as recently indicated by Hua (2007), Klein, Schuh, and Triest (2003), Frenkel and Ros (2006) and Ngandu (2008).

In the case of The United States of America, Blecker (2007) describes empirical evidence showing that there is a significant negative effect of real dollar appreciation

on aggregate investment in the United States manufacturing industry, the effect is transmitted through liquidity rather than changes in the desired capital stock by firms. If we assume this relationship, coupled with the fact that increasing government expenditures is likely to increase the stock of government debt; then, competition for capital with the private sector and flows of financial resources will increase too.

However, previous studies have neglected the implications of government debt as a channel of transmission of exchange rate in employment; even Ngandu (2008) disregarded the role of government debt when making a thorough analysis of the channels of transmission of exchange rate. Thereby, this study seeks to analyze the effects of government debt on employment demand, considering the role of exchange rate as a variable that changes the relative prices of the factors of production. The inclusion of exchange rate is very important for an economy that is highly integrated into global markets through financial activity and trade.

Hua (2007) exposed the negative relationship between real exchange rate and manufacturing employment in China for selected provinces during the period 1978-2003. Hua stated that in the 1993-2002 period, the average rate of Chinese currency appreciation was 4.1% per year, while job creation was at the average rate of -2.3%. Essentially, increasing unemployment occurred. This phenomenon coincided with lower exports compared to the 1981-1993 period. Then, it seems that as the currency appreciates, the demand for exports decrease, in turn, these combined factors decrease labor demand in the economy. The real effective exchange rate is defined as the nominal effective exchange rate multiplied by the ratio of consumer prices between domestic prices and foreign partners; thus, an increase in the real exchange rate implies a real appreciation of the domestic currency.

Hua found that in Fujian, Guangdong, and Zhejiang provinces employment increased at an annual average rate of 2.9%, 1.4% and 1%, respectively; despite an annual average real appreciation of the Chinese currency of 4%, 3.2% and 4.4% respectively. This fact shows how job creation and job destruction occur due to exchange rate movements, suggesting that it is very likely that switching of sectoral employment in the Chinese economy has occurred. This phenomenon has also been observed by Campa and Goldberg (2001) and Ngandu (2008). Output and capital/labor intensities are expected to be positively and negatively correlated with employment demand, respectively.

We would expect that the greater the output the greater the employment level, while expansion on the use of capital would reduce employment. Hua (2007) found that 1% output expansion increases employment by 0.74% and that 1% increase in capital intensity reduces employment by 0.5%. Appreciation of the real exchange rate is then detrimental to employment, Hua (2007) states that higher international competition and higher wages occur. He found that for 1% increase in the real exchange rate, employment decreases by 0.69%; but the exchange rate also has effects on capital/labor intensity, exports and the exports/GPD ratio.

The research work of Hua (2007) can be improved by analyzing many economic sectors simultaneously, like the work of Ngandu (2008). Ngandu analyzed the effect of the exchange rate on the employment level in different sectors of the South Afri-

can economy. Different levels of aggregation of the different sectors of the economy can be used, taking into consideration demand and supply factors as it was done by Branson and Love (1986). Another possible route of improvement is to analyze the impact of the exchange rate on different measures of labor market activity; Campa and Goldberg (2001) used wages, employment (number of jobs and hours), overtime employment, and overtime wages. Also, a dynamic analysis of the variables in the model could be performed, with the intention of noticing the short and long run effects of exchange rate on employment.

Industries with high (low) openness are likely to show positive (negative) response in employment demand due to a depreciation of exchange rates (Kim 2005). The exchange rate also has effects on the trade deficit. Zhenhui (2008) found a long term relationship between the real exchange rate and the trade deficit. Exchange rate movements have effects on the short run economic activity and economic growth; and then, as indicated by Frenkel and Ros (2006), the exchange rate has effects on the unemployment rate. In other words, the exchange rate affects the amount of labor employed in the economy, since it ends up determining domestic prices.

Financial activity also plays a role on the determination of an exchange rate, a measure of financial markets activity needs to be included because it has effects on the flows of money and trade; thus, on the employment level. For example, in the case of the Mexican economy in the period 1971 through 1988, De La Cruz (1999) found a long term relationship between domestic credit, real exchange rate and international reserves. According to this monetary approach, an exogenous increase in domestic credit is likely to cause losses in international reserves that cause exchange rate depreciations; but, as suggested by Wu, Chen, and Le (2001), the balance of payments will be in a sustainable path if exports and imports are co integrated for counteracting the loss of international reserves.

By means of a bivariate vector autoregressive model, Zhenhui (2008) evaluated the relationship between the value of the Chinese currency, Renminbi (RMB), and the trade deficit with the United States. Although the Chinese government has been criticized by The United States for manipulation of the exchange rate, the author did not find a short run relation between the mentioned variables; but there was a significant relationship in the long run. Consequently, an appreciation of the RMB/$ was likely to reduce the United States trade deficit with China.

So, depreciated foreign currencies have implications on the demand for United States output. For instance, Branson and Love (1986) have found that real appreciation of the United States dollar reduces the competitiveness of output in the manufacturing sector that is directly or indirectly substitutable for foreign output. Since the appreciation of the currency reduces demand for domestic output due to changes on relative prices; consequently, the appreciation reduces the demand for labor. Branson and Love (1986) found that the largest exchange rate effects are in the mining and manufacturing sectors, as one would expect, with durable goods showing larger effects than non-durable goods. Capital goods that are produced domestically are increasingly substituted with cheaper imports due to appreciation of the exchange rate.

However, recently, Goldberg and Knetter (1997) and Gust, Leduc, and Vigfusson (2010) documented that import prices have become less responsive to currency changes in part due to market segmentation and market integration, respectively. As such, if markets become more competitive then firms have to adjust their profits by finding cost savings technologies that leads to adjustments on employed labor and capital requirements or by changing the revenue structure of the firm; moreover, firms may also hedge risks in the financial markets which allows them to respond more effectively to fluctuations on the foreign exchange value of currencies.

Greenaway, Hine, and Wright (1999) state that between 1979 and 1991 the United Kingdom industry became increasingly integrated into the international economy through trade and foreign direct investment. By analyzing 167 manufacturing industries, Greenaway, Hine, and Wright (1999) found that the simultaneous phenomenon of increasing unemployment and stable production in those industries necessarily imply that output per person has been rising; although, they found high variation in productivity.

This suggest that trade promotes efficiency in domestic industries; this is what Hua (2007) has referred to as the efficiency transmission channel of exchange rate and Frenkel and Ros (2006) as the labor intensity channel. Therefore, openness to trade would reallocate the factors of production towards more profitable enterprises; moreover, policies that have favored the promotion of exports emphasize the trading sector of the economy. The reallocation of resources from trade will create employment in those industries that are competitive; thus, as Greenaway, Hine, and Wright (1999) has point out "openness serves to increase the efficiency with which labor is utilized in the firm".

Greenaway, Hine, and Wright (1999) suggests that "lags may also be introduced into the labor demand function once bargaining considerations are taken into account such as sequences of bargains or expectations formation about future wage and output levels", as bargaining occurs, the factors that cause rigidities are worked out, the market then finds a new equilibrium. However, in general, the labor market is characterized by being more rigid in comparison to the markets for goods and financial instruments where adjustments in supply and demand are accomplished faster; thus, price changes are able to reflect greater amount of information.

As the economy receives shocks, equilibrium is going to be restored in the employment level at a slower rate due to rigidities (real wages, contracts, unions, social costs of the unemployed, costs of firing and hiring, costs of training and search of new employees, etc). Because of these rigidities, excess demand or excess supply of labor will be eliminated, requiring some time to reach the new equilibrium after the shock. Thereby, a lag structure is needed, Greenaway, Hine, and Wright (1999) suggest that if there exists serially correlated technology shocks more lags may be needed.

Movements in the exchange rate change the relative prices of domestic goods, exports and imports, and with these changes in prices, there is a new allocation of resources depending on the degree of persistence of the variability of the exchange rate. Lastrapes and Koray (1990) studied the relationship between exchange rate volatility

and real activity denoted by output; using a vector autoregressive model (VAR), it was determined that the relationship is weak. Exchange rate volatility is not Granger-independent of the variables in the system, and the state of the economy strongly effects volatility (Lastrapes and Koray 1990). So, in a way, the exchange rate is a signal of the overall condition/state of the economy. By using the same measures of exchange rate volatility, Koray and Lastrapes (1989) established that it does not affect the trade flows in the economy; but permanent shocks decreased imports, even more on flexible regimes compared to fixed exchange regimes. These results are aligned with those of Campa and Goldberg (2001), who found that transitory exchange rate movements have greater effects on overtime hours worked and overtime wages.

Transactions between individuals from different countries and currencies achieve a price for services, goods and financial instruments either in domestic or foreign currency. Independent of the arrangement, one currency will be exchanged for another, thus, the exchange rate will be determined. The impact of the exchange rate in the economy will depend on the degree of internationalization of the industries (exports, imported inputs, imported intermediate inputs, etc.), thus, the exchange rate will have effects on the labor market according to the market conditions of the industry and overall state of the economy.

Campa and Goldberg (2001) indicated that the degree of effect of the exchange rate on labor demand will depend on the competitive structure of the industry, the skill level of the labor involved in the industry, and other factors related to trade orientation. Kim (2005) states that it has been shown that industries with high (low) openness show positive (negative) response in employment demand due to depreciation of the exchange rate; Kim (2005) also found the same response in industries with low (high) imported input ratio since employment demand was likely to respond positively (negatively).

From a panel study of Italian firms, Nucci and Pozzolo (2008) determined that the number of jobs and worked hours are responsive to sales and imported inputs; wages are affected by the real exchange rate and they decline even more when the firms' sector has lower monopoly power and higher foreign competition. Campa and Goldberg (2001) state that labor demand is less responsive to exchange rate when production is labor intensive, it has a higher import penetration and when export orientation raises the sensitivity of labor demand to exchange rates; they also mentioned that depreciation of the exchange rate causes labor demand to decrease when the industry relies on imported inputs due to higher production costs in domestic currency.

Frenkel and Ros (2006) has stated that "from a Keynesian perspective, it is well known that there is a positive relationship between depreciation and exports" and considering other factors that contribute to aggregate demand, a depreciated currency would increase the demand for factors of production such as labor and capital. Consequently, exports have a positive effect on the employment level and pace of economic growth.

Fu and Balasubramanyam (2005), for the case of China over the time period 1987–1998 in 29 provinces, found that foreign direct investments and exports provided

an effective demand not only for the surplus capacity of their capital stock but also for the surplus of labor. As a result, a depreciated exchange rate not only stimulates exports but also FDI. In the case of the United States, Blecker (2007) found empirical evidence that there is a significant negative effect of real dollar appreciation on aggregate investment in the United States manufacturing industry, the effect is transmitted through liquidity rather than changes in the desired capital stock by firms. In the case of Vietnam, Xuan and Xing (2008) found that exports are influenced by not only the exchange rate but also by foreign direct investment. The FDI export elasticity was 0.13 while exchange rate export elasticity was 0.47, implying that depreciation of the exchange rate stimulated exports. The drawback of the research is that FDI was measured by approved FDI rather than FDI stocks. So, financial market activity and speculation play a role in the determination of exchange rate as suggested by Vargas-Silva (2009) and Soto (2008).

FDI stimulates growth in exports depending on foreign aggregate demand. The increased demand of labor caused by FDI and the added value of exports caused by domestic and foreign firms will depend on the share of inputs that are imported in the production process. Arndt (2006) refers to this as production sharing; therefore, production sharing affects the trade balance due to fluctuations in the exchange rate. But, the effects will depend on the mobility of capital and labor, the degree of price rigidity and the level of unionization in the labor market.

Movements in real exchange rates cause adjustment of labor demand due to the effect on profits, especially to those firms with high share revenue from exports or costs of imported inputs; consequently, changing relative prices produce creation and destruction of jobs, see for example Hua (2007), Klein, Schuh, and Triest (2003), Frenkel and Ros (2006) and Ngandu (2008). Klein, Schuh, and Triest (2003) implemented an economic model of gross job creation and losses applied to detailed United States manufacturing industries between 1973 and 1993 to elucidate the effects of the real exchange rate (trend and cycle) on labor reallocation. They found that the real exchange rate significantly affected job reallocation but it did not affect net employment; the cyclical component of the real exchange rate affected only net employment through job losses.

Movements in bilateral real exchange rates generate a wide range of responses within traded-goods industries because trade patterns differ markedly across industries (Klein, Schuh, and Triest 2003). A study by Frenkel and Ros (2006) states that an increase in the labor intensity of traded goods due to an increase in the real exchange rate occurs through either the adoption of more labor-intensive techniques or greater reallocation of labor and investments toward labor intensive tradable goods.

Frenkel and Ros (2006) studied Latin American countries (Argentina, Brazil, Chile, and Mexico), and found that two years later after an appreciation (depreciation) of 1% in the real exchange rate, a 0.56% increase (fall) in the unemployment rate followed. So, it seems that countries have incentives to have undervalued currencies. They also found that a 1% increase in gross domestic product was associated with a 1.49% decrease of the unemployment rate.

Ngandu (2008) studied the relationship of the exchange rate and employment in South Africa. Forty three aggregated sectors were analyzed; the response of employment to exchange rate shocks was significant and varied depending on the level of openness of the industry. Ngandu made a thorough analysis of the channels of transmission of exchange rate to employment by including developmental macroeconomic, factor intensity, external orientation, imported input and import penetration, market structure, trade liberalization, and openness; government debt is disregarded either as a depreciating factor of the currency or as an opposing force to job losses.

Previous literature indicates that there is a negative relationship between the exchange rate and labor demand, studying as channels of transmission the role of exports, substitution of factors of production, terms of trade, openness, and productivity. But, in general, Soto (2008) has argued that existing models of exchange rate determination have ignored labor market characteristics. And ignoring the government response to worsening labor markets is a mistake and a conundrum to be unfolded that needs greater understanding.

Thereby, this research pursues to untangle the effects on employment by increasing government debt accumulation while considering the effects of government debt on the foreign exchange value of the dollar in the post Bretton Woods period. As previously documented, the exchange rate affects productivity, and government debt depreciates the currency, so it is assumed that government debt has effects on the growth of productivity through the exchange rate. So, if we use a standard production function, Cobb Douglas for instance, this assumption would imply that government debt has effects on total factor productivity (TFP) channelized through the exchange rate. After controlling for income and capital, the exchange rate has been assumed to shift TFP which in turn has impact on employment demand, this specification has been used by Greenaway, Hine, and Wright (1999); Fu and Balasubramanyam (2005) and Hua (2007).

Although these studies were focused primarily on understanding how exchange rate impacts labor markets, it is worthwhile to recognize that these insights can be considered into the study of the relation between debt and employment, since it is expected that government debt has broader impacts on the economy beyond direct spending. In the following section, the implemented econometric methods are briefly discussed.

Econometric methods and data

The relation between employment and government debt is investigated for The United States of America by using a dynamic specification of the demanded labor; it takes into consideration the effects of government debt on the exchange rate which in turn are assumed to have effects on labor demand. In accordance with the theoretical insights previously discussed, the variables to be included in the econometric model are the level of employment, income, nominal interest rate, government debt, and exchange rate. All the pecuniary variables are implemented in real terms and logarithmic

transformations. Following Frenkel and Ros (2006), the gross domestic product (GDP) is used as a proxy measure for income.

The econometric model is specified in vector error correction form (VEC) due to integration of the variables and common trends found in the data. Thus,

$$\Delta \mathbf{y}_t = \boldsymbol{\alpha}\left(\boldsymbol{\beta}\mathbf{y}_{t-1} + \boldsymbol{\mu} + \boldsymbol{\rho}t\right) + \sum_{j=1}^{p-1} \boldsymbol{\Pi}_j \Delta \mathbf{y}_{t-j} + \boldsymbol{\gamma} + \boldsymbol{\tau}t + \mathbf{u}_t \quad (1)$$

where ρ and τ are assumed to be zero, so that there is a trend in the un-differenced data and the co integration equation is stationarity around a non-zero mean, see Enders (2004). The error term u is assumed to be Gaussian with the usual properties. The parameters α and β correspond to the error correction terms and the long run estimates from the co integrating equation, respectively.

In order to implement the co integration tests, the variables should have the same order of integration, i.e. I(1); this research project will use the DF-GLS test for unit roots, and other tests will be implemented as a way to corroborate and/or to discern the stationarity of the variables, such tests are the ADF test, the KPSS test and the Phillips and Perron test.

Lag selection for the co integration tests and the estimation of the VEC model used information criteria such as AIC, BIC, HQ, and those suggested by Lütkepohl (2005) as well as likelihood ratio tests. Co integration among the variables was evaluated by the Johansen test by determining the rank of the VEC model; two tests are implemented, the trace and the maximum eigenvalue statistic. If zero rank is found among the variables, then, the model is specified as a vector autoregressive in first differences. If the variables are stationary, the estimation of the model will consist of vector auto regressions, *i.e.* a VAR model in levels.

The inclusion of deterministic terms such as structural breaks and deterministic trends was evaluated by likelihood ratio tests as in equation (2); where Ll_0 and Ll_1 are the log-likelihood values related to the estimated models under the null and alternative hypotheses, respectively. The null hypothesis of the test assumes that the evaluated deterministic terms equal to zero.

$$LR = -2(Ll_o - Ll_1) \quad (2)$$

The statistic follows a χ^2 distribution with the degrees of freedom equal to the number of deterministic terms being evaluated. However, the final decision lies on whether the estimated parameters are statistically significantly different from zero and/or the residuals conform to white noise process. Moreover, the parameter estimates in (1) should result in a stable vector auto-regressive model for ensuring that is invertible and consequently it has an infinite-order vector moving-average representation (Enders 2004; Lütkepohl 2005). Next, the data is described concisely.

The chosen time series correspond to the post Bretton Woods System of monetary management among industrialized countries, far beyond the initial shock in 1971 for eliminating the noise that appeared from newly adopted policies for exchange

rate, financial liberalization and policies that have promoted freer trade and economic coordination. Given the high openness of the country in terms of trade and financial markets, the exchange rate is included in the model as a shock absorber of fiscal and monetary policies in the form of an index that represents the underlying value of the US dollar relative to a group of currencies.

The dataset has quarterly observations that span from 1973:1 up to 2010:3. The econometric model consists of five variables, a measure for the labor market, an indexed measure for the exchange rate, the real interest rate, total federal government debt and the gross domestic product. The last two variables were deflated by using the GDP deflator.

The chosen measure for exchange rate is the trade weighted exchange rate index of major currencies. It measures the relative value of the United States dollar against the currencies of the Euro Area, Canada, Japan, United Kingdom, Switzerland, Australia, and Sweden. The index uses 1973 prices as the benchmark for comparisons across years, the data was obtained from the Federal Reserve Bank of St. Louis; an appreciation (depreciation) of the United States dollar is captured by an increase (decrease) of the index. On average, the index has declined 0.19% per quarter.

Data for the nominal gross domestic product was obtained from the Bureau of Economic Analysis and it measures the economy's output in billions of United States dollars. The deflated measure of GDP was obtained using the GDP deflator that is released by the same bureau. The deflator uses 2005 prices for comparisons. In the sample period, the nominal gross domestic product grew an average of 1.58% per quarter, while in real terms the growth rate was 0.746 on average.

Data for total federal government debt was obtained through the Federal Reserve Bank of St. Louis; it is compiled from the Financial Management Service Office of the United States Department of the Treasury. It is measured in billions of United States Dollars, and it was deflated using the GDP deflator previously described. The gross total federal government debt had an average growth rate of 2.21% per quarter; in real terms the growth rate was 1.37% per quarter. Total government debt is defined as the sum of debt held by the public and government borrowings from federal trust funds such as Social Security and Medicare.

As for the labor market, the employed labor was measured by the total number of individuals that are employed in the economy (16 years and over), measured in thousands. Data for both variables was obtained from the Bureau of Labor Statistics. On average, employed individuals grew 0.372% per quarter. The cost of capital is denoted by the nominal interest rate on treasuries; it is represented by real yields on US Treasuries with 10 years to maturity. For obtaining the real interest rate, the effects of inflation were removed by using the percentage change in the Consumer Price Index. The CPI is benchmarked with an average value equal to 100 for the 1982-84 years. The chosen CPI pertains to all urban consumers for all items, it is generated by the Bureau of Labor Statistics and it was obtained through the Federal Reserve Bank of St. Louis. On average, the real interest rate declined 0.588% per quarter.

In the period 1973:1-2010:3, 151 observations were obtained; the descriptive statistics of the variables in the dataset are presented in table 1. The lowest coefficient of variation was found on the exchange rate index, with an estimated value of 14.15%. As for the employed labor, its coefficient of variation was 16.02%. Moreover, the coefficients of variation for deflated GDP, real interest rate and deflated government debt were 32.03%, 39.18% and 54.70%, respectively (table 1).

Table 1
Descriptive statistics of the observations in levels, 1973:1 – 2010:3

Variables	*Mean*	*Std. Dev.*	*Min*	*Max*
Total Federal Government Debt	4168.58	3237.64	457.32	13561.62
Gross Domestic Product	6911.25	4119.49	1335.10	14745.10
Employment	117971.00	18904.17	83841.66	146264.30
Exchange Rate	96.75	13.69	70.83	142.06
Real Interest Rate on 10 Year Treasuries	6.19	2.42	2.30	13.40
Deflated GDP	8692.97	2784.19	4795.14	13363.47
Deflated Debt	4931.30	2697.26	1540.20	12212.73

Source: Elaborated by author.

Empirical results

The correlation coefficients among the variables were significantly different from zero at the 95% confidence level. The maximum absolute magnitude of the correlation coefficients occurred on deflated GDP with employed labor (.98), while the minimum absolute magnitude was found on between the exchange rate and employment (-.56), Table 2. However, the partial correlation coefficient between deflated debt and the employed labor was -0.1538; such coefficient was significantly different from zero at the 10% level of significance. Such coefficient is calculated after removing the effects of deflated GDP, real interest rate, and the exchange rate.

*Table **2***
Correlation structure of the variables, 1973:1 – 2010:3

	ER	*RIRATE*	*DGDP*	*EMLA*	*DFDEBT*
Exchange Rate	1				
Real Interest Rate	0.662	1			
Deflated GDP	-0.580	-0.658	1		
Employment	-0.556	-0.573	0.980	1	
Deflated Debt	-0.654	-0.672	0.964	0.937	1

Source: Elaborated by author.

The variables that represent government debt, employment and gross domestic product seem to have clear upward trends. As for real interest rates and the trade weighted exchange rate of major currencies, a downward trend is evident. Eyeballing the data to discern trends is not a substitute for formal testing of unit roots. Such testing, will determine if in fact there is statistical evidence about the non-stationary properties of the variables. The Dickey–Fuller generalized least-squares test for a unit root (DF-GLS) were used in the logarithmic values of the variables, such results are displayed in table 3. Two rounds of tests were performed. The first set corresponds to tests of the variables in levels whereas the second set corresponds to the tests in first differences.

From the first set of tests, it was determined that the DF-GLS tests fail to reject the null hypothesis of non-stationarity in all the variables at the 5% level of significance, the interpolated critical values came from those calculated by Elliott, Rothenberg, and Stock (1996). Given that the data presented trends, the specification of the alternative hypothesis assumed that the time series are stationary around a linear time trend (table 3).

In the second set of results depicted in table 3, correspond to first differences of the transformed variables in logarithms, the Dickey–Fuller generalized least-squares tests rejected the null hypothesis of non-stationarity of all variables at the 5% level of significance; the exception was total federal government debt. For such variable, the test rejected the null hypothesis only at the 10% level of significance with one lag.

Table 3
DF-GLS test results for unit roots

Lags	*Real Interest Rate*	*Exchange Rate*	*Employment*	*Deflated GDP*	*Deflated Debt*
Variables in levels with trend					
7	-1.092	-2.692	-1.062	-2.466	-1.970
6	-1.325	-2.622	-1.104	-2.591	-2.036
5	-1.226	-2.365	-1.003	-2.414	-2.180
4	-1.263	-2.358	-1.053	-2.447	-2.709
3	-1.418	-2.363	-1.313	-2.383	-1.946
2	-1.467	-1.934	-0.745	-2.442	-1.720
1	-1.733	-2.202	-0.735	-2.099	-1.321
First differences without trend					
7	-2.449	-1.586	-1.993	-4.183	-0.625
6	-2.955	-1.657	-1.889	-3.914	-0.926
5	-2.954	-1.821	-2.182	-4.033	-0.992
4	-3.805	-2.199	-2.579	-4.479	-0.976
3	-4.779	-2.510	-2.854	-4.818	-0.634
2	-5.768	-2.954	-2.876	-5.285	-1.331
1	-8.190	-4.521	-3.744	-5.786	-1.836

Source: Elaborated by author.

Note: For tests with trend, the critical values for 1%, 5% and 10% levels of significance are -3.519, -2.979 and -2.689, respectively. For tests without trend, the critical values for 1%, 5% and 10% levels of significance are -2.593, -1.95 and -1.613, respectively.

In addition to DF-GLS tests, augmented Dickey–Fuller (1979) tests were also conducted, they are depicted in table 4. The series in levels were tested under the alternative of stationarity around a linear time trend. The tests fail to reject the null hypotheses of unit root at 5% level of significance for all variables. The tests on the logarithmic first differences resulted in rejection of the null hypothesis of non-stationarity of all the variables at 5% level of significance. Again, the exception was total deflated federal government debt. Therefore, further analyses were conducted for this variable. In conclusion, since the variables appear to be stationary in first differences, their corresponding order of integration is 1, *i.e.* I(1).

Since both DF-GLS and ADF unit root tests rejected the null hypothesis of non-stationarity on the first difference of the series total deflated government debt, additional tests were conducted. The Phillips and Perron (1988) test, which is robust to autocorrelation and heteroskedasticity, rejected the null hypothesis of non-stationarity at the 5% level of significance (critical value = -2.887), the estimated statistic was -6.788. Furthermore, additional tests were conducted in different periods; same conclusion was reached. In addition, the KPSS test by Kapetanios, Shin, and Snell (2003) was conducted. The estimated statistic was 0.26598, in this way the null hypothesis of stationarity was not rejected at the 5% level of significance since the corresponding critical value was 0.464. In conclusion, both Phillips and Perron (1988) and Kapetanios, Shin, and Snell (2003) tests for unit roots provide statistical evidence that the first difference of the logarithmic transformation of total federal government debt is in fact stationary; therefore, it is inferred that the variable in levels has an order of integration I(1).

Table 4
Results from Augmented Dickey–Fuller unit root tests

Variables	*ADF Statistic**	*Critical Values*		
		1%	*5%*	*10%*
Levels with trend				
Real Interest Rate	-2.790	-4.024	-3.444	-3.144
Exchange Rate	-2.501	-4.024	-3.444	-3.144
Employment	-1.095	-4.024	-3.444	-3.144
Deflated GDP	-2.347	-4.024	-3.444	-3.144
Deflated Debt	-1.932	-4.024	-3.444	-3.144
First differences without trend				
Real Interest Rate	-7.582	-3.495	-2.887	-2.577
Exchange Rate	-5.214	-3.495	-2.887	-2.577
Employment	-4.446	-3.495	-2.887	-2.577
Deflated GDP	-4.993	-3.495	-2.887	-2.577
Deflated Debt	-2.642	-3.495	-2.887	-2.577

Source: Elaborated by author.
*Note: Dickey-Fuller tests were augmented with 3 lags.

Co integration analysis of employment demand

Having determined that the variable of interest follow similar order of integration I(I), the co integration analysis was conducted. The co integrating equation contains the variables that explain employment demand, such as deflate government debt, the exchange rate index, real interest rate and deflated GDP; in this way, there are five variables in the statistical model. The trace tests and the maximum eigenvalue tests were performed for determining the number of co integrating equations within the five variables. For both tests, two specifications of the trend were evaluated. The first specification allowed for a trend in the co integrating equation; this specification is favored not only by the unit root tests but also by the underlying economic fundamentals that assume shifts in productivity. The second specification restricted the trend to zero, so that the co integrating equation becomes stationary around a nonzero constant. The test results are conditional on the selection of the length of the lags in the underlying vector auto-regressive model; for theses tests a length of five lags was selected.

The co integration results are depicted in Table 5. According to the trace statistic under the specification of restricted trend, the five variables appear to have at most one co integrating equation at 1% level of significance, whereas at 5% it appears that there are at most two. In contrast, the maximum eigenvalue tests at both levels of significance, fail to reject the null hypothesis that the maximum rank is one. Under the second specification, that is with unrestricted constant, the trace test failed to reject the null hypothesis that the maximum rank is one at 1% level of significance. The trace test failed to reject the null of two co integrating vectors at 5% level of significance. The results from the trace statistic contrasted those from the maximum eigenvalue test. In conclusion, at 1% and 5% levels of significance, the tests favored the existence of one co integrating equation in the data.

The long run effects of government debt on employment demand are estimated by maximum likelihood, following the methods described in Johansen (1995). From the previous analyses, there is enough statistical evidence to believe that the five variables have at the most one co integrating vector. For this reason, the normalization of the co integrating vector assumes that the coefficient on employment is equal to -1, so that the estimates can be interpreted as estimates for the long run employment demand function. According to Ewing and Payne (1999), this specification is commonly applied in monetary economics.

The normalized co integrating vectors for the employment demand function are depicted in table 6 for two specifications, restricted trend (model 1) and unrestricted constant (model 2). Both specifications produced the expected signs and the magnitudes for the effects of real interest rate and exchange rate varied slightly by 0.02% in absolute terms. The effects of GDP were not only significantly different from zero but also it is noticeable how the magnitudes varied, in model 1 the effect was 33.06% higher than in model 2.

All of the coefficients were statistically different from zero at the 1% level of significance with the exception of the effects of debt when the specification of the

model allowed for linear trends in the levels of the data. In the first specification, the magnitude of the trend was -0.003, such coefficient was very significantly different from zero; implying that in the long run, employment demand is decreasing although at a very slow rate.

Table 5
Cointegration results for the employment demand function

Rank	*Trace statistic*	*Critical Values*		*Max Eigen.*	*Critical Values*	
		5%	*1%*	*Statistic*	*5%*	*1%*
Restricted trend						
0	109.4708	87.31	96.58	42.0629	37.52	42.36
1	67.4079	62.99	70.05	28.1659	31.46	36.65
2	39.2421	42.44	48.45	19.7355	25.54	30.34
3	19.5065	25.32	30.45	12.898	18.96	23.65
4	6.6086	12.25	16.26	6.6086	12.52	16.26
Unrestricted constant						
0	84.047	68.52	76.07	35.1109	33.46	38.77
1	48.9361	47.21	54.46	22.5264	27.07	32.24
2	26.4097	29.68	35.65	16.9598	20.97	25.52
3	9.4499	15.41	20.04	6.9043	14.07	18.63
4	2.5456	3.76	6.65	2.5456	3.76	6.65

Source: Elaborated by author.

The discussion and interpretation of the long run effects will focus on the first specification. The long-run federal government debt elasticity of labor demand was positive, and calculated at 0.03%, although the estimate is three times smaller than the long run interest rate elasticity and long run exchange rate elasticity. Additionally, for comparative purposes, the effect of government debt is 29 times smaller than the effect of real GDP. The growth in productivity is detrimental to employment demand, since it is assumed that debt and exchange rate had effects on productivity, these variables are expected to have a negative effect on employment. However, the estimated long-run federal government debt elasticity of employment was small and positive.

This result suggests that in the long run government debt expands the use of labor in the economy; the finding is robust as the analysis controlled for growth in productivity, interest rates, real GDP, and the exchange rate. As the United States government expands its programs, the use of debt to finance deficits is slightly compatible with the expansionary use of labor in the long run; specially, because governments are likely to use more debt during recessionary periods when unemployment has risen and the employment level is declining, so in a way, debt is counteracting the effects of productivity that reduces the demanded labor in the economy. However, we have to consider that federal government debt is more likely to be incremented when budget deficits

are increasing and these are likely to occur when there has been an economic contraction, as measured by either GDP or employment, which in turn negatively affect consumer demand, a very important component of the United States economy.

According to the estimates, a decrease in the interest rates would have a negative effect on employment demand. This result implies that as capital becomes cheaper, in the long run, the expansion of the economy will consume more of that factor and labor as input is not that different from others. In this way, as the economy enters into a new equilibrium, the amount of utilized labor is reduced as capital costs are reduced. Therefore, an increase in the interest rate is likely to have a positive effect on employment demand since the long run interest rate elasticity of labor demand was estimated at 0.09% (Table 6). This estimated coefficient was significantly different from zero at 99% level of confidence.

The absolute effects of GDP on labor demand are greater than debt, interest rate and exchange rate. The long-run GDP elasticity was calculated at 0.88; suggesting that changes in the growth of GDP are matched almost completely by changes in the growth of labor demand in the long run. As such, I would suggest that for a stable employment demand in the economy, its growth should not exceed that of GDP; because a contraction in GDP will bring a proportional decrease in labor. The exchange rate had a similar effect than interest rate in absolute magnitude. A depreciation of the dollar, according to the exchange rate elasticity would increase labor demand in the long run.

Table 6
Normalized co integrating vectors for employment demand

*Model**	*Deflated Debt*	*Real Interest Rate*	*Exchange Rate*	*Deflated GDP*	*Trend*
			Model 1		
Parameter	0.0302	0.0905	-0.0930	0.8797	-0.003
Standard error	0.0115	0.0059	0.0166	0.0809	0.0006
			Model 2		
Parameter	-0.0060**	0.1141	-0.1153	0.5491	
Standard error	0.0231	0.0116	0.0319	0.0413	

Source: Elaborated by author.
* All of the coefficients were significantly different from zero at 1% level of significance.
** This coefficient was not significantly different from zero at 10% level of significance.

This is in accord with the conception —discussed previously— that as debt depreciates the currency, exports growth would occur; and, as exports grow the demand for labor increases as well (McMillin and Koray 1989; McMillin and Koray 1990; Hua 2007). Thus, the most remarkable result is that, in The United States of America, labor demand is affected by the accumulated federal government debt in the long run as well as by interest rates and the exchange rate; implying that labor markets react to both changes in financial markets and fiscal policy outcomes; albeit, the changes to fis-

cal rules are sluggish due to the legislation process, making fiscal policy more difficult to react than financial and labor markets.

Discussion and conclusions

In the last decade, the United States federal government has relied even more on public spending to stimulate the economy by aiming either to increase the level of employment or to de-accelerate the growth in the unemployment rate in comparison to previous decades. The American Recovery and Reinvestment Act, the Emergency Economic Stabilization Act and the Economic Stimulus Package are salient examples of the most recent and increasing reliance on accumulation of government debt for positioning the economy out of a recessionary path and bringing it back into previous levels of economic activity.

Furthermore, under the administration of George W. Bush, a tax reduction policy was pursued along with increasing government spending on healthcare for seniors and a two-front-war in Iraq and Afghanistan. As of August 2015, major tax breaks are still in place, they were renewed by Congress under the leadership of the Obama administration. As for the war in Afghanistan, it is still ongoing since 2001. Thus, for a long time now, the United States economy is under a seemingly tax policy that is not sustainable, clearly there is a revenues–spending discrepancy that is matched only by the ability of the government to issue debt. In the economics literature, deficit spending has been traditionally associated with Keynesian economics whereby government plays an important role as the last option to influence economic outcomes, from investments, production decisions to labor market indicators.

The short term influence of both fiscal and monetary policies in recessionary periods has being studied extensively, however, the long term effects of debt accumulation as opposed to recurrent government deficit spending has remained without much deserving attention. Especially, given the openness of most powerful economies, the role of government debt accumulation has being neglected by previous studies that deal with the effects of exchange rate on employment through prices of input and output or through the direct effects on higher level of government spending.

As such, this study has bridged that gap by studying the effects of United States government debt accumulation on employment, and at the same time, this study accounted for the effects of the foreign exchange value of the United States dollar. From the delineated conceptual framework, it is assumed that if the accumulation of government debt tends to depreciate the currency, then, as a result of the changing value of the currency the prices of the factors of production are very likely to change as well.

Consequently, by assuming that economic agents maximize profits, they will tend to readjust the amount of capital and labor that is used in the economy as currency shocks are experienced. At this point, these unexpected changes in the value of the currency can originate from either debt or any other changing factor affecting the global economy and currencies. Thus, as the economy accumulates more debt to finance government spending, currency depreciation and the direct effects on new

investments are likely to change the levels of production, and consequently, the levels of employment in the economy.

Empirically, after analyzing the properties of the data series, it was determined that the effects of government debt accumulation on employment were better assessed by a vector error correction model. A long-run-stable relation was found between employment, GDP, interest rate, the exchange rate and federal government debt. The co integrating equation was trend stationary. The long run effects of government debt in the level of employment were positive and smaller in comparison with the effects of interest rate, exchange rate and GDP. The signs of the parameter estimates of GDP and exchange rate conformed to the economic theory; as such, the results indicated that a depreciating currency increases the demand for labor while changes in GDP are accompanied by positive changes in the demand for labor.

The estimated long-run federal government debt elasticity of labor demand was 0.03, it was statistically significantly different from zero at the 1% level of significance, when the labor demand equation accounts for a trend. However, when the trend is constrained to zero in the labor demand equation, a negative sign was obtained for the estimated long-run debt elasticity of labor demand (-0.0060) but such parameter estimate was not statistically different from zero at 10% level of significance.

Then, altogether, these results imply that government debt not only serves as an automatic stabilizer of the economy, by contributing to GDP through new investments or higher consumption, but the estimated results also show that debt functions as a generator of employment in the long run; so, giving enough time to an economy after a substantial government debt increment —while holding other factors constant— we can expect a decline in unemployment as well as a positive shift in the amount of people that the economy employs.

Once a government receives the financial resources from a debt issuance, how debt is spent may determine the long term impact on the economy. For instance, a country with weak institutions may not spend it in consumption or investment as much as a country with a more effective bureaucracy; moreover, depending on the degree of corruption of a nation, part of that debt can effectively exert more impact abroad than at home. Although this is more important for developing nations, the main point of the previous argument is to clarify that how government debt is spent does matter, it does affect the magnitude of the immediate impact on consumption, investment and future production levels.

Later, these conditions impact the exchange rate valuation of the currency that bear subsequent changes in prices of inputs and output, and substitution of goods and services, along with future tradeoffs in subsequent decisions of consumption, investment, and production by all economic agents including government itself–albeit rather conditioned by productivity. In the case of The United States of America, I would also suggest that federal government debt allows for the financing of research y development that bring about increments in productivity, which expands consumption, new investments, and production levels that are later reflected in GDP growth

and in turn has important effects on business formation and subsequent expansion in the amount of labor that is being employed in the economy (Pessoa, 2010).

The inclusion of the foreign exchange value of the currency is very important for an economy that is highly integrated into global markets through trade and financial activity. In the long run, holding all other factors constant, I consistently find that a depreciating change of the currency had a positive effect on labor demand, implying that the level of employment increases as the United States dollar decreases in value relative to other currencies, and vice versa. This finding does not contradict previous research. For example, Hua (2007) found such relationship in China while Frenkel and Ros (2006) found it on 13 Latin American countries.

However, previous studies that focused on the relationship of exchange rate and labor demand have disregarded the effect of government debt accumulation either through exchange rate —as a depreciating factor of the currency— or directly through changes in GDP by way of consumption, production, or investment; these mechanisms are disregarded even by Ngandu (2008) who made a thorough review of this literature.

In all, the presented empirical evidence has shown that the exchange rate value of a currency has long term effects on the amount of labor that an economy employs, and given the government debt-exchange rate relationship (McMillin and Koray; 1989, 1990) the exchange rate serves as a channel of transmission of government debt. Consequently, this study has contributed on the analysis of the effects of government debt accumulation on labor demand, controlling for the important role of the exchange rate as a variable that changes the relative prices of economic output and the factors of production channelized though shifts in productivity.

The effects of the exchange rate on the labor markets were in accordance with the findings of Branson and Love (1986), Frenkel and Ros (2006), Hua (2007), and Ngandu (2008) in that employment tends to decrease after the currency appreciates. The effects of the exchange rate significantly affected labor demand in the long run. However, these finding applies to an aggregated measure of employment —and as pointed by Campa and Goldberg (2001)—, the effects of the exchange rate may differ according to industry characteristics and the type of change in the exchange rate. But still, altogether, the discussed empirical evidence provides support for the hypothesis that United States government debt changes the foreign exchange value of the dollar, which leads to price fluctuations of output and labor; if there is an increase in the stock of debt, then, as the currency depreciates —more labor is likely to be employed.

Even though it was assumed that fluctuations in the value of the currency change the prices of the factors of production, only the cost of capital was included in the analysis explicitly; as such, future research should include a more explicit measure of the cost of labor. In this study, it was implicitly supposed that nominal wages tend to be more rigid in comparison to real wages; that is, for the most part, variation in the real value of wages is originated from inflation rates variation.

As for the response of employment to an increase in the real interest rate (10-year United States Treasuries), it was found that the use of labor is increased in the long run, *ceteris paribus*. As expected in the formulation of the employment demand

function, holding other variables constant, if the cost of capital increases relative to the cost of labor, then, more labor is expected to be employed in the economy. In other words, a low-interest-policy is detrimental for an economy with large unemployed segments of its population; thus, this implies that purchases of capital goods are working as perfect substitutes for labor in the long run. However, this finding deserves more attention in future research as it contradicts the policy recommendation of low interest rates to boost GDP by increasing consumption, credit, and investments which foster a declining unemployment environment (Taylor 1993; Gallmeyer, Hollifield, and Zin 2005; Bhamra, Fisher, and Kuehn 2011).

The implications of this study may be limited by three major conditions. Firstly, the United States economy is currently the largest one in the world. Secondly, its sheer size is backed by credible financial institutions, a credibility that is supported by foreign central banks and investors that fund purchases of government debt; this provides an incredible advantage in accessing to credit in world markets. And thirdly, the central bank of The United States of America —the Federal Reserve— has repeatedly shown willingness to accommodate monetary policy. This accommodation has been persistently observed since the last great recession in 2008, interest rates have been kept at very low levels until now while monetization of government debt has being faced-out in the quantitative easing programs. These conditions limit the extrapolation of the implication of the results to other economies that may be large or open, but lack a strong central bank that is effectively able to manage a robust currency.

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