The political economy of twin deficits and wage setting centralization

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Abstract

This paper contributes to the literature on current account imbalances among industrialized economics. The main novelty of the paper is to introduce a political economy framework which explains why industrialized economies with more centralized wage bargaining system have typically better current account balances compared to their counterparts with decentralized wage bargaining. It is assumed that the government follows preferences of workers in the non-traded sector (median voter theorem). An increase in the fiscal deficit and, hence, in the current account deficit, by issuing external public debt leads to an appreciation of the real exchange rate. As the between-sector labor mobility is constrained by friction in the labor market, relative wages in the non-traded sector rise. The opposite happens if the government improves the two balances by rising its savings. Thus, non-traded sector workers relatively support (oppose) more a rise (reform) in the two deficits. Centralization of wage bargaining moderates sectoral benefit and costs from such twin-deficit policies by reducing the responsiveness of sectoral wages with respect to sectoral prices. Thus, non-traded-sector workers support (oppose) less a rise (reform) in the two deficits if the wage bargaining system is more centralized. Correspondingly, more wage centralization reduces the government's political incentive (cost) to deteriorate (reform) the external balance through its budget balance. This theoretical prediction is tested using a panel data which include 16 major OCED countries over the period of 1980-2012. The main result of the empirical part of the paper suggests that wage centralization is associated with lower twin deficits (lower current account deficit and lower fiscal deficit).

Keywords: Twin deficits, Current account imbalances, Dutch disease, Search and Match, Wage bargaining Centralization, Real Exchange rate.

JEL-Classification: F32, E62, J31, J51, F41.

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1 Introduction

Global current account imbalances have been focal points of interest in international macroeconomics, especially since the financial crisis in 2007/2008. Many authors argue that the global imbalances and the global financial crisis are intimately connected.[1] The crucial importance of the subject in policy-oriented debates and the fear for re-emergence of another financial crisis have motivated a large body of theoretical and empirical research to identify fundamental determinants of global current account patterns. The related literature generally argues that saving glut in fast-growing emerging markets and in oil countries, as well as, financial, institutional and macro variables can, to a large extent, explain observed global current account imbalances.[2]

Nevertheless, less research has been devoted to study the role that the structure of the labor market can play in the determination of the current account position of a country. The present paper focuses on one aspect of the labor market, i.e. the degree of centralization of wage setting. The impact of wage centralization on macroeconomic performance has been studied in the literature. The consensus is that extremes work best for employment and growth. However, no research has been devoted to the role that wage centralization can play in the determination of external balances.

This paper provides a theoretical model, supported by some econometric analysis, which suggests a positive relation between wage centralization and current account. The empirical results of this paper demonstrate that higher wage centralization is significantly and positively associated with current account balances in the cross-section of advanced economies. Besides, the results suggest that this link is, to a great extent, through the positive correlation between wage centralization and budget balance. In other words, it is argued that wage centralization is associated with a lower public deficit which can be translated to a lower external deficit (the twin deficit hypothesis).[3]

The mechanism relies on a political economy framework which presumes that the government uses the fiscal balance and its external debt position as a tool for preserving its office.[4]

[1] See for example Obstfeld and Rogoff (2009) and Caballero and Krishnamurthy (2009).

[2] According to the existing literature, these variables include budget balance, financial development, demographic variables, stage of development, terms of trade volatility and previously accumulated foreign reserves.

[3] The twin deficit hypothesis has been studied by a large number of theoretical and empirical papers (see for example Chinn et al. (2014) and Chinn and Ito (2007)). Empirical studies generally suggest that 1% increase in the fiscal deficit leads to around $0.1\% - 0.3\%$ increase in the current account deficit.

[4] The role of political incentives, for managing the fiscal balance has been studied by previous literature.

In such a framework, it is assumed that the government, when managing its balance, follows preferences of workers in the non-tradeable sector (notably construction and services), since they construct the majority of society in all industrial economies. I argue that wage centralization reduces the N-sector workers' thirst for widening the public external debt and their dismay for a reduction in public external debt. This affects the political incentive of the government in managing its balance. The mechanism introduced in the paper is as follows:

A rise in the budget deficit, by issuing external debt, can improve the short-term aggregate welfare through tax reduction and/or through an increase in public good provision. At the same time, it leads to a surge in the inflow of external capital (as long as the Ricardian equivalence fails to be complete). This external capital induces a symptom of Dutch disease: appreciation of real exchange rate, i.e. an increase in the relative price of the N-sector products. Friction in the labor market severely constrains the between-sector labor mobility. As a result, the surge in the twin deficits induces an inter-sectoral wage dispersion in favor of the N-sector. Consequently, workers in the N-sector support more such a twin deficits policy compared to workers in the tradeable sector (T-sector), who are adversely affected by the loss in the international competitiveness of their sector and, hence, by the decline in their wage (in terms of aggregate price level). For the same reason, the workers in the N-sector relatively oppose more reforms in the twin deficits.

Centralization of wage bargaining decreases this distributional effect by reducing wage flexibility, i.e. the sensitivity of sectoroal wages with respect to sectoral prices (and hence, to changes in real exchange rate).[5] Thus, the gains and losses from the twin deficits are smaller. Consequently, wage centralization moderates N-sector workers' support for the deterioration of the two balances and their oppositions to the reform in the two deficits. Correspondingly, if the wage bargaining is more centralized, the policy maker, following N-sector workers' preferences, finds less political support for widening its external debts and also faces less political costs for improving the two balances.

To the best of my knowledge, this paper is the first attempt to study the relationship between wage centralization and current account. Nevertheless, some links can be deduced by combining the findings of related literature. The most related studies are the ones on

See for example Alesina et al. (1998) and Velasco (1999).

[5] Holmlund and Zetterberg (1991), Hartog et al. (2002) and Teulings and Hartog (1998) have shown that sectoral wage dispersion, after controlling for labor-skills and job conditions, and the responsiveness of the sectoral wages to sectoral prices is lower in countries with more centralized wage bargaining system. This impact of wage centralization will be discussed more precisely later.

inequality-current account relationship. Kumhof et al. (2012), Behringer et al. (2013) and Marzinotto (2016) have shown that in the cross-section of industrial economies, a rise in inequality is associated with an increase in external deficit. This link is explained by the negative impact of inequality on households savings. Given the negative impact of wage centralization on personal income inequality, one can expect that wage centralization can improve the current account via encouraging households saving. Our empirical results confirms the chain of these three linkages: inequality-current account, inequality-households savings and wage centralization-inequality. However, no significant evidence is found for positive impact of wage centralization on households saving. This can be explained by the positive effect of wage centralization on budget balance: positive impact of wage centralization on public savings tends to reduce the households savings through an incomplete Ricardian effect. This negative impact offsets the positive impact of wage centralization on households saving through reducing inequality.

The rest of the paper is organized as follows: section 2 discusses the various strands of literature which are related to this paper. Section 3 reviews some historical facts related to the purpose of this paper. Section 4 is devoted to an econometric analysis. Section 5 establishes the theoretical model. In section 6 I run a numerical analysis to demonstrate the theoretical mechanism. Finally, section 8 concludes.

2 Literature review

Four strands of literature are relevant to this paper. The literature on (i) current account imbalances, (ii) wage centralization, (iii) the Dutch disease impact of windfall incomes, and finally, (iv) search and match frictional labor market.

Literature on current account imbalances

The research on current account imbalances was firstly motivated by the large current account deficit in the US starting from the 1990's. Bernanke et al. (2005) and Clarida (2005) attribute this dramatic trend in the US external balance to saving glut in Asian emerging-market countries and the oil exporters, ranging from Persian gulf countries to Norway. In more global point of view, this perspective may fail to explain why it is that the US, UK, Ireland and specific other advanced economies run substantial external deficits, while other industrial countries such as Germany, Nordic countries, Japan and the Netherlands have usually experienced external surpluses.

Recently, empirical papers tried to identify the possible determinants of external balance using panel regressions (see for example, Chinn and Prasad (2003), Cheung et al. (2013) and Gruber and Kamin (2007)). Some empirical papers turned their focuses to the imbalances in advanced economies (Decressin and Stavrev (2009) and Barnes et al. (2010)). The empirical section of my paper is inspired by this literature. It is worthwhile for the aim of this paper to mention that most of these studies find evidence for the twin deficit hypothesis (see for example Chinn et al. (2014), Bluedorn and Leigh (2011), Chinn and Ito (2007) and Chinn and Ito (2008)).

Very recent literature find empirical evidence that inequality is negatively associated with current account balance in industrial economies. In an innovative contribution Kumhof et al. (2012) argue that in advanced economies with developed financial markets, rising inequality leads to a deterioration of current account balances as the poor and middle classes borrow from the rich and from foreign lenders to finance their consumption. Marzinotto (2016) also finds that establishment of Euro area improved the external balance of more equal countries, whilst it deteriorates that in more unequal economies.

Belabed et al. (2013) by accounting for both personal and functional income distribution, argue that with upward-looking status comparisons, an increase in personal income inequality gives rise to "expenditure cascades" and deteriorates aggregate saving rate (see also Frank and Levine (2007) and Frank et al. (2010)). On the other hand, an increase in functional inequality, i.e. a fall in the households income share and an increase in the corporate income share, encourages the aggregate saving (since the capitalists/firms have higher propensity to save compared to the households) and improves the current account. Behringer et al. (2013) tested these hypotheses empirically and found that rising top household income share significantly deteriorates the current account. They also found tentative evidence that current account increases as a result of a decline in the share of wages in value added. The results on the functional income distribution are also related to my paper since aggregate wage level can be influenced by wage centralization. The relation between households income share and current account can be different if the financial markets are integrated. In that case, low aggregate wage can attract external capitals due to higher return on investment. In the next section the relationships between wage centralization, households income share and current account will be discussed more precisely.

literature on wage centralization

The macroeconomic impact of wage centralization has been studied by a large number of papers. Calmfors and Driffill (1988) show that there is a hump-shaped relationship between

the aggregate level of wage and the degree of wage centralization.[6] Even though the impact of wage centralization on wage level can play a role in the determination of private savings and that of current account balances, a more important role of wage centralization, for the aim of this paper, is its impact on inter-sectoral wage gaps and on the responsiveness of sectoral wages with respect to sectoral prices. Rycx (2002); Kahn (1998); Blau and Kahn (1999); Edin and Zetterberg (1992) show that, after controlling for workers skills and job conditions, the inter-sectoral wage gaps tends to be lower in countries with more centralized wage bargaining systems. Holmlund and Zetterberg (1991), Hartog et al. (2002) and Teulings and Hartog (1998) showing the same result, conclude that industry wages in more decentralized countries are more responsive to sectoral prices and productivity changes. By contrast, industry wages in more centralized economies (Nordic countries for example) are largely unaffected by the sectoral conditions.

Literature on Dutch disease

The theoretical model of this paper is, in some of its features, inspired by theoretical studies on the Dutch disease impact of natural resource and foreign aid. This literature consider a small open economy with two sectors: (i) tradeble and (ii) non-tradeable. This theoretical framework allows capturing the two symptoms of the Dutch disease raised by a shock in windfall income: (i) reallocation of resource from the T-sector to N-sector and (ii) appreciation of real exchange rate. The main references in this strand of literature are: Corden and Neary (1982), Torvik (2001) and Matsuyama (1992). My theoretical model differs from those mentioned above by considering the search and match friction in the labor market. This friction implies a short-term sectoral-wage dispersion as a result of a shock in the windfall income. The windfall income in the current study is the foreign resource used by the government to finance its deficit. [7]

Literature on search & match frictional labor market

The theoretical model incorporates search and match frictional labor market to account for short term impact of a shock in the twin deficits on sectoral wages. The search & match feature of the model extends Mortensen and Pissarides (1994), Mortensen and Pissarides (1999b) and Mortensen and Pissarides (2001) by allowing for two-sector economy. multiple-

[6] Therefore they conclude that countries with high level of wage centralization and countries with very decentralized wage bargaining system have better economic performance and less unemployment rate compared with their counterparts with medium level of wage centralization, i.e. the countries in which the wage is set in industry level.

[7] To the best of my knowledge, my paper is the first in combining the Dutch disease and Search & Match frameworks, even though the wage distributional impact of windfall income has important implications on the political economy of natural resource abundance.

sector search & match model is studied by previous literature such as Hosios (1990), Davidson et al. (1987) and Davidson et al. (1988). The theoretical model of this paper differs from this literature by introducing wage centralization which is aiming to reduce the inter-sectoral wage gap as a response to a shock in sectoral relative prices (shock in real exchange rate).

3 Historical facts

The main hypothesis of this paper is that wage centralization reduces the current account through its negative impact on fiscal deficit. In this section, I focus on some stylized facts which are related to this hypothesis. The mechanism explained by this paper incorporates the twin deficits hypothesis. Some empirical papers have found evidence that 1 percent decrease in fiscal deficits (% GDP) reduces the current account by 0.1-0.3 percent of GDP.[8] Bluedorn and Leigh (2011) control for changes in fiscal policies that are motivated primarily by fiscal deficit reduction, and hence, are largely uncorrelated with other factors affecting current account. They find that 1 percent of GDP fiscal consolidation raises the current account-to-GDP ratio by about 0.6 percent. As a historical example, in Belgium, budget balance deficits started to decline from -16 (% GDP) in 1981 to a surplus of 0.2% in 2001. This led to a continuous improvement of the external balance from -4 (% GDP) in 1981 to +4,5 (% GDP) in 2001. The experience of the US in the beginning of 2000's is a well-known historical example of the link between the two deficits. The US budget balance (% GDP) fell continuously from 0.26 in 1999 to -4.7 and -4.3 in 2003 and 2004, respectively. In the same period, the current account (% GDP) dropped from -3 in 1999 to -5,2 and -5,7 in 2004 and 2005, respectively.

A standard implication of expansionary fiscal policy and its associated deficit in current account is appreciation of real exchange rate. The impact of the twin deficits on real exchange rate has been studied by empirical papers (See for example Bluedorn and Leigh (2011)). Theoretically, the link between the twin deficits and real exchange rate can emerge from the Mundell-Fleming model with flexible exchange rates, from open-economy general equilibrium with non-Ricardian features, as discussed by Obstfeld et al. (1996) and from the Dutch disease hypothesis:[9] An increase in the budget deficit, when Ricardian effect fails to be complete, leads to inflow of capital from the rest of the world. The inflow of capital

[8] See for example Alesina et al. (1991), Lee et al. (2008), Bussière et al. (2010), Chinn and Ito (2008) and Chinn et al. (2014).

[9] In the theoretical model of this paper, this mechanism is used to explain the impact of the twin deficits on real exchange rate.

increases the aggregate demand and deteriorates the trade balance. While the surge in the demand for traded goods can be satisfied by higher import, the supply of non-traded goods, such as services and construction, is limited to domestic productions. Therefore, in short-term a rise in the twin deficits and its associated capital inflow increases the relative price of the N-sector (which represents real exchange rate).

An increase in the relative price of the N-sector results in a reallocation of production factors from the T-sector to the N-sector. On the other hand, sector-specific labor skills and friction in the labor market, translates the appreciation of real exchange rate to shifts in sector wages in favor of the N-sector. The US data confirms these links. Figure (1,b) represents the employment ratio between the N-sector (services and construction) and the T-sector (manufacturing sector). While the general trend is an increase in the employment share of the N-sector, this increase was accelerated between 1999 and 2008 financial crisis. Figure (1,a) represents the ratio between the average wage unit costs of the N-sector and that of the T-sector with reference to the ratio in 2010 (i.e. the ratio in 2010 is normalized to unity). This figure shows that the general trend has been the increase in the ratio in favor of the N-sector unit wage cost.[10] However, the trend was accelerated between 1999 and 2007. Therefore, these two figures are consistent with the short-term impacts of the twin deficits on factors reallocation and on inter-sectoral wage dispersion which is implied by the variation in real exchange rate.

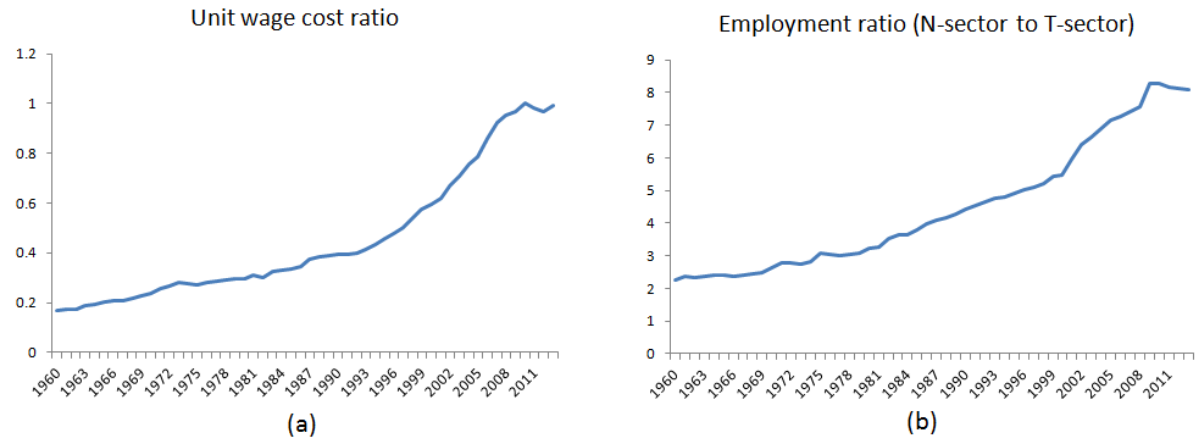


Figure 1: (a) US ratio between the average of unit wage cost in N-sector and T-sector with reference to 2010. (b) US employment ratio between N-sector and T-sector. (Source of data: AMECO)

[10]The increasing trends can be explained by productivity rise and also the upturn in capital insensitivity of the T-sector.

These facts show that, when the government deteriorates the current account by increasing its deficits, the households affiliated to the N-sector enjoy the boost in that sector, while the households in the T-sector lose from less competitiveness of their sector and from a decline in their wage (in terms of domestic price level).[11] The other feature, which is used in the mechanism explained by this paper, is political economy framework. The government, trying to keep its office, is more concerned with preferences of the majority. In all the industrial economies, a large and increasing majority of households are engaged in service and construction sectors. In the US for example, around 67% and 30% of employees were affiliated to the N-sector (construction and service) and T-sector (manufacturing), respectively, in 1960. These numbers changed to 88% and 11% in 2013. The same pattern can be found in other industrial economies. In 2013, the N-sector employment constituted about 88%, 90%, 82% and 78% of total employment in France, UK, Japan and Italy, respectively. Therefore, from a political economy point of view, one can expect that the government in industrial economies be mostly concerned with the impact of its policies on the N-sector workers and pay less attention to the consequences of its policies on the T-sector workers.

Wage centralization can play a role in this framework by moderating the impact of twin deficits policies, and hence that of changes in real exchange rate, on sectoral wages. It is known from the literature that wage centralization tends to reduce the responsiveness of sectoral wages with respect to sectoral prices. For example, Rycx (2002); Kahn (1998); Blau and Kahn (1999); Edin and Zetterberg (1992)) using cross-sectional analysis have shown that inter-sectoral wage gaps, after controlling for individual workers' skills and job conditions, tend to be lower in countries with more centralized wage bargaining system. Holmlund and Zetterberg (1991), Hartog et al. (2002) and Teulings and Hartog (1998) obtain the same result and conclude that industry wages in more decentralized-wage-system countries are more responsive to sectoral prices and productivity changes. In the framework of this paper, wage centralization moderates benefits and losses from twin deficits policies and the changes in real exchange rate. From this channel, wage centralization can influence the political incentives of governments in managing their fiscal balance through external debt/saving: governments in more centralized-wage countries find less political incentive for increasing their deficits through issuing foreign debts. They also face less political cost for improving their external debt position by reducing their fiscal deficits.

Hence, the prediction made by this mechanism is that countries with more centralized wage bargaining system tend to have lower budget deficits compared to their counterparts

[11] Workers who have more sector-specific skills are more touched by the policy.

with more decentralized wage bargaining system. This also implies more surplus in external balance for more centralized-wage economies if countries share the same characteristics in terms of other factors which may affect the current account. Figure (2,a) shows the relationship between non-overlapping 10-year averages of budget balance ($\%GDP$) and wage centralization during the period of 1980-2010 for countries mentioned in table 4. Wage centralization is measured by Iverson index. This index takes into account both level of wage setting and enforceability of bargaining agreements (Iversen (1998)).[12] The source of the data for the Iverson index is AIAS.[13] This index is ranged from 0, representing a system in which wage is completely decentralized and set at individual level, to 1, representing completely centralized wage bargaining system where all the wages are set by bargaining between unique national union and employer association.[14] This database provides yearly Iverson index for several industrial economies from 1960 to 2012. Table 4 in Appendix B indicates the 10-year averages of the Iverson index for these countries during the last four decades. The rank orderings of countries according to different indices of wage centralization are reported in table 5. These rankings are induced by the indices suggested by the following papers: *(i)* Calmfors and Driffill (1988), *(ii)* Schmitter (1981), *(iii)* Cameron (1984), *(iv)* Blyth (1979) and *(v)* Bruno and Sachs (1985). As one can see in the table, the differences between the ranking induced by Iverson index and the other rankings in table 5 are minor.

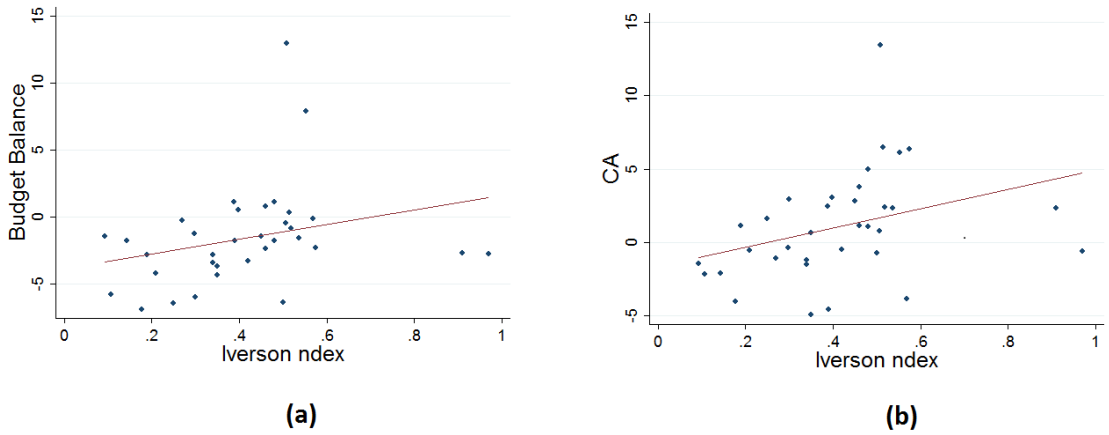
Figure (2,a) suggests a positive relationship between wage centralization and budget balance. Figure (2,b) shows the relationship between non-overlapping 10-year averages of current account ($\%GDP$) and wage centralization for the same countries and for the same period of time. This figure also suggests that higher centralization of wage bargaining tends to go hand-in-hand with better external balance position in the cross section of industrial economies.

So far, I have explained a mechanism through which wage centralization can have positive impact on the current account through the budget balance. However, other channels can be identified through which wage centralization can have positive or negative effects on the current account. One of these channels is the impact of wage centralization on households savings through reducing inequality. The impact of personal inequality on private saving, and, hence on the current account, has been studied by recent literature (e.g. Kumhof et al.

[12]These two dimensions are recognized by empirical papers as main variables affecting sectoral wage-to-price responsiveness (see for example Wallerstein (1999)).

[13]Amsterdam Institute for Advanced Labor Studies.

[14]In the sample of industrial economies used in this paper, the Iverson index is ranged between 0.1 (USA and UK) to 0.6 (Nordic countries) with the exception for Austria for which the Iverson index is above 0.9 in most of the years.



Wage centralization is measured by Iverson index. Each point in panels (a) and (b) represents, respectively, 10-year average of budget balance and current account for non-overlapping periods between 1970-2000.

Figure 2: **(a)** Budget balance (% GDP) vs. Iverson index, **(b)** Current account (% GDP) vs. Iverson index.

(2012) and Behringer et al. (2013)). Given inequality-households savings relationship, wage centralization can improve the current account if it reduces personal income inequality. I investigates this channel in Appendix B. The main findings confirm the results obtained by previous studies on wage centralization-inequality and on inequality-current account relationships. However, the findings demonstrate that wage centralization has no significant impact on households savings. The possible explanation can be that the positive impact of wage centralization on households savings through reducing inequality is offset by the negative impact of the former on the latter through increasing public saving (Ricardian effect).

The other possible channel through which wage centralization can affect current account can be through the impact of wage centralization on wage level. Low level of aggregate wages increases the international competitiveness of tradeable sector and can improve trade balance, and hence, the current account. Moreover, as Behringer et al. (2013) argue, a fall in the household income share (wage income) in value added (and, so, an increase in the corporate income share) increases the aggregate saving and improves the current account.[15] The impact of wage centralization on aggregate wage level was initiated by Calmfors and Driffill (1988). They found a hump shape relationship between wage level and the degree of wage centralization. More precisely, they showed countries with high level of wage centralization (with dominant bargaining at national/inter-sectoral level) and the countries with very decentralized wage bargaining system (bargaining at firm/individual level) tend to have lower aggregate wage compared to their counterparts with medium level of wage centralization,

[15]Since firms/capitalists have more propensity to save.

i.e. the countries in which the wage is set at industry/sector level. Taking into account these two strands, one can expect that countries with medium level of wage centralization can moderate the wage income share if they pass to national level or to more decentralized wage bargaining system. Related to this mechanism, the so called German miracle has been put forward by some literature to support the idea that the decentralization of wage bargaining can improve the external balance by restraining wage growth. This historical example is discussed in Appendix A. The German miracle is worth being discussed since it is in contrast with empirical findings of this paper which support a positive relationship between wage centralization and current account.

4 Econometric analysis

In the previous section, I document some stylized facts that support positive relationships between wage centralization and the two balances. However, there are a number of other candidate explanations for the two balances, some of them likely to be correlated with wage centralization. To account for this issue, I perform a multivariate analysis of current account and budget balance determinants using a panel of 16 OECD countries over the period 1980-2012. The sample of countries is constrained by the availability of data on wage centralization index. The countries included in the econometric analysis are the ones reported in Table 4, excluding Austria which is an outlier in terms of the Iverson index.[16] In the first subsection, I test if wage centralization has explanatory power for current account. In this subsection I also test whether the twin deficits hypothesis holds for the sample. In subsection 4.2, I examine whether the positive association between wage centralization and current account can be explained by the relationship between wage centralization and budget balance. In subsection 4.3, I test the relationship between wage centralization and households savings, to test whether wage centralization can influence current account through households savings. Moreover, In Appendix B, I evaluate the relationship between wage centralization and inequality expressed alternatively as top 1% and 5% income shares and I test the hypothesis that wage centralization can affect current account through reducing inequality.

[16]The Iverson index for all the countries in the sample are between 0.1 and 0.6. The Iverson index for Austria in different years varies from 0.9 to 0.96 which is much higher. Therefore, in the regressions, Austria is excluded from the sample. With Austria included, the coefficient of the Iverson index is not significant anymore. Nevertheless, once I account for the squared of the Iverson index, the coefficient of the Iverson index becomes significant again, while the coefficient for the squared variable is negative and not always significant.

4.1 Current account and wage centralization

In this subsection, I test whether wage centralization has explanatory power for medium-term of current account positions of industrial economies. Besides, I test for the validity of the twin deficits hypothesis. The theoretical model of this paper argues that wage centralization improve current account by reducing the fiscal balance. To empirically account for this issue, I implement the following strategy for different specifications and robustness checks: as a baseline model, I estimate current account (% GDP) using a benchmark set of explanatory variables which are used in the literature. This benchmark set includes budget balance and I test whether the twin deficits hypothesis holds in the sample. Key references in this literature include Chinn and Prasad (2003), Gruber and Kamin (2007), Chinn et al. (2014) and Kumhof et al. (2012) and other papers mentioned in table 7. In the second step, I test whether wage centralization (represented by Iverson index) has significant explanatory power for current account once it is substituted for budget balance in the baseline model. Finally, I test a model in which both wage centralization and fiscal balance are included in the regression. Since, this model argues that the wage centralization can affect current account through budget deficit, one can expect that including the two variables in the regression at the same time must reduce the significance and magnitude of either or both variables. Therefore, the following three specifications are considered for different measurements of the variables:

$$\frac{CA_{i,t}}{GDP_{i,t}} = \beta_0 + \beta_B \quad BudgetBalance_{i,t} + \beta X_{i,t} + \epsilon_{i,t} \tag{1}$$

$$\frac{CA_{i,t}}{GDP_{i,t}} = \beta_0 + \beta_C \quad WageCentralization_{i,t} + \beta X_{i,t} + \epsilon_{i,t} \tag{2}$$

$$\frac{CA_{i,t}}{GDP_{i,t}} = \beta_0 + \beta_{BC} \quad BudgetBalance_{i,t} + \beta_{CB} \quad WageCentralization_{i,t} + \beta X_{i,t} + \epsilon_{i,t} \tag{3}$$

The dependent variable is the current account (as percentage of GDP) in order to control for scale effects. $X_{i,t}$ is the benchmark set of explanatory variables that, in line with the existing literature, includes:

- **Initial net foreign assets (%GDP**: Theoretically, the initial level of net foreign assets can have either a positive or negative effect on current account balance. On the one hand, initial net foreign assets can be used to finance trade deficits which may create a negative link between initial net foreign assets and the external balance. On the other hand, net foreign asset position affects positively the primary investment income from abroad, potentially leading to a positive relationship with the current

account. Empirical studies have generally shown that the second channel is dominant. In fact, the NFA position is the accumulation of the past current account surpluses. Hence, the lagged value of the NFA, expressed as percentage of GDP, is used in the regressions to avoid capturing a reverse link from the current account balance to net foreign asset.

- **Relative income**: To capture the stage of development effects, the variable relative per capita income is routinely included in the current account regressions. I use the ratio of per capita GDP relative to the U.S. level. In anticipation of real convergence, private agents increase external borrowing to smooth their long-term consumption at an earlier stage of development. In addition, economic theory predicts that capital-rich developed countries export capital to more labor intensive countries where the productivity of the capital is expected to be higher. From both channels, relative income is expected to have positive impact on the current account balance.

- **Financial development**: On the one hand, financial development has been viewed to encourage saving by reducing transaction costs and facilitating risk management. On the other hand, financial development can be interpreted as a proxy for the borrowing constraints faced by individuals in an economy, and can, therefore, be associated with higher levels of private borrowing. The impact of financial development on domestic investment, which is the other side of current account, is expected to be positive. Although no strong priority is given to the relationship between financial deepening and the current account, I include this variable in our cross-country regressions. Private credit (% GDP) is used to measure the financial development.

- **Demographic variables**: The life-cycle hypothesis suggests that the saving behavior of households varies with age and is hump-shaped, reflecting higher levels of borrowing at younger phases, increased saving during the productive years, and a return to dissaving at the retirement age. I use old and young age dependency, as well as, population growth as a proxy for demographic variables.

- **GDP growth**: Faster GDP growth makes the households expect higher income levels relative to the present and, hence, households increase their consumption out of current income. Besides, higher growth resulting from productivity gains can attract foreign capital. For both reasons, GDP growth is expected to have negative impact on the current account balance, although this result is not very robust across the related studies on industrial economies. To control for GDP growth, I use alternatively,

changes in per capita GDP growth and GDP growth averages (the second one is used for robustness check).

The sources and descriptions of the data used in the regressions are reported in table 6. The regressions do not include the country fixed effect (similar to Chinn and Prasad (2003), Gruber and Kamin (2007) and Chinn et al. (2014)), since including country-specific means prevents the model from analyzing cross country differences in current account and detracts from much of the economically meaningful parts of the analysis.[17] Moreover, for the most of the regressions, I use alternatively non-overlapping 3-year and 5-year averages of the data. This is due to the fact that the main interest of this paper is the medium term impact of wage centralization on current account. This procedure which is widely used in the literature (see for example Chinn and Prasad (2003), Gruber and Kamin (2007) and Cheung et al. (2013)) has also the advantage of abstracting from cyclical effects and other high frequency noises in the data. For robustness check, I reestimate the models with the annual data. The estimation with 5-year averages of data includes 6 periods of time between 1982-2011 and for 3-year averages, 11 periods between 1980-2012.

Besides, I account for two different measurements of independent variables: (i) deviations from the GDP-weighted sample mean (with the exception of net foreign assets, relative income and Iverson index) and (ii) level data. The rationale for accounting for demeaning variable is to emphasize that current account balances are relative measures and their movements are influenced both by domestic and foreign economic conditions.[18]

The summary of the results for the baseline model (equation 1) is reported and compared with the literature in table 7 for the sample-demeaned data and for the level data (the results are associated with 5-year averages data). This table shows that our general results are consistent with the existing literature. The detailed results for this baseline specification are reported in columns (1) and (4) (corresponding to 5-year averages and 3-year averages of data, respectively) of tables 1 and 8 (corresponding to sample-demeaned data and level

[17]The main concern of this paper is wage centralization index. The time variation of this variable within the countries is small. Therefore, controlling for time-fixed-effects will prevent capturing the impact of this variable on dependent variables. In the regressions, I always control for Hausman test to ensure that using regressions with random effects does not have significant effect on the coefficient of the explanatory variables.

[18]The rationale that the Iverson index is used as level rather than the deviation from sample mean is that its impact on current account is through the political incentives of the government for managing its budget. Therefore, its impact is independent of the centralization of wage in the rest of the world. For robustness check, I account also for deviated measurement of the Iverson index. The results are not sensitive to the choice of measurement of the Iverson index, even though in some regressions the coefficient of this variable becomes less significant with demeaned measurement.

data, respectively). The results confirm the twin deficits hypothesis in all the regressions. The impact of the fiscal deficit on the current account is relatively lower for regressions with the sample-demeaned data. Moreover, the coefficient less than one implies a significant but not complete Ricardian effect. The impacts of population growth, initial net foreign assets and relative income are significant and consistent with the theory in all the regressions. In the regressions with level data, financial development and old-dependency ratio are not significant and they have opposite sign as theory suggests. However, they become significant with consistent signs in the regressions with sample-mean deviation of the data. I found no significant impact of young-dependency ratio in level-data regressions, but significant with opposite sign with the theory in the regressions with sample-mean deviation of data.

Wage centralization and current account

Since the purpose of this paper is to show the impact of wage centralization on current account and since the argument is that the mechanism goes through budget balance, I test a model in which wage centralization is substituted for budget balance (equation (2)). The results for the two regressions by 5-year and 3-year averages of data and for level data and deviation data are reported in columns (2) and (5) of tables 8 and 1, respectively. The results suggest a significant and positive association of wage centralization and current account: a higher level of wage centralization is associated with larger current account surpluses (or smaller current account deficits). Note that the Iverson index which is used as a proxy for wage centralization, varies from around 0.10 to 0.6 in my sample. Thus, for example, one can interpret the coefficient of the Iverson index in column (2) of table 1 as follows: ceteris paribus, changing the wage centralization from the most decentralized case to the most centralized case in our sample can lead to the improvement of current account by around 3.6% of GDP.

In the next step, I include both wage centralization index and fiscal balance in the regression (equation (3)). Columns (3) and (6) of tables 8 and 1 represent the results for regressions with 5-year and 3-year averages of data and for level data and for sample-demeaned data, respectively. The results show that including both Iverson index and fiscal balance at the same time, reduces coefficients and the significance of either or both variables. For example, comparing the coefficients of the Iverson index in columns (5) with the one in column (6) in both tables 8 and 1 demonstrates that when the budget balance is not included in the model, the coefficient of the Iverson index is significant at 5 percent level, while when budget balance is included at the same time, the coefficient for wage centralization is not significant any more. These results can imply a correlation between the two variables. In the next

subsection, I test if wage centralization has explanatory power for budget balance.

In order to examine the robustness of the results at higher frequencies, I reestimate the panel regressions for level data using the annual data rather than 5-year and 3-year averages. The results are reported in columns (1) and (2) of table 9. While the other variables seem to have the same effects as before, wage centralization seems to have no significant impact on current account in the annual regression. Since the data for wage centralization of Australia are mostly reported for every two or three years, there are many omitted observations which can influence our results, in annual regressions. Hence, in columns (3) and (4) of table 9, I exclude Australia from the sample. In this case, the coefficient for wage centralization is significant at 5 percent level again and the coefficient is close to the one in the regression with 3-year average data. The fact that the coefficient of wage centralization is more significant in 5-year averages specification than in the specifications with higher frequencies suggests that the impact of wage centralization on current account is mostly a medium-term impact.

Table 1: Panel Regression, OLS specification, Deviated from GDP-weighted sample mean

Current account	5-year averages			3-year averages		
	(1)	(2)	(3)	(4)	(5)	(6)
Govt. budget balance	0.256***		0.171*	0.310***		0.272***
	(0.089)		(0.097)	(0.070)		(0.077)
Iverson index		6.532**	6.111*		6.286***	3.691
		(3.007)	(3.186)		(2.105)	(2.465)
Private credit ratio	-0.022**	-0.024**	-0.018**	-0.016**	-0.013*	-0.013*
	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)	(0.007)
Δ GDP growth	0.732	0.368	0.565	0.394	0.183	0.386
	(0.652)	(0.624)	(0.640)	(0.248)	(0.257)	(0.252)
Net foreign asset	0.054***	0.064***	0.063***	0.052***	0.059***	0.056***
	(0.009)	(0.010)	(0.010)	(0.007)	(0.007)	(0.008)
Relative income	4.650***	4.913***	3.851**	3.267***	4.336***	2.752**
	(1.601)	(1.643)	(1.644)	(1.241)	(1.254)	(1.321)
Population growth	-4.135***	-3.776***	-3.953***	-4.227***	-3.907***	-4.182***
	(0.953)	(0.963)	(0.949)	(0.722)	(0.736)	(0.739)
Trade openness	0.010	-0.010	-0.003	0.007	-0.004	0.002
	(0.010)	(0.012)	(0.012)	(0.008)	(0.009)	(0.009)
Old dependency ratio	-0.262**	-0.250**	-0.257**	-0.296***	-0.261**	-0.297***
	(0.121)	(0.127)	(0.121)	(0.097)	(0.102)	(0.104)
Young dependency ratio	0.108	0.208*	0.174	0.077	0.155*	0.106
	(0.113)	(0.118)	(0.116)	(0.090)	(0.089)	(0.093)
Constant	-4.052***	-5.874***	-5.017***	-2.730**	-5.253***	-3.355**
	(1.530)	(1.664)	(1.613)	(1.193)	(1.191)	(1.345)
Rsquared	0.67	0.65	0.69	0.62	0.58	0.63
Observations	89	91	89	156	158	153

Standard errors are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

4.2 Government budget balance and wage centralization

In the previous subsection, I showed that wage centralization is significantly and positively associated with current account once it is substituted for budget balance in the baseline model of current account estimation. Moreover, I showed that the twin deficit hypothesis holds for the considered sample of industrial economies. In this subsection, I test if wage centralization has explanatory power for the budget balance when it is added to a set of explanatory variables of the public budget balance. Given the twin deficits hypothesis, if wage centralization reduces the public deficit, one can expect that wage centralization improves current account.

To test this hypothesis, I estimate the budget balance by controlling for the Iverson index and a set of some candidate explanatory variables which are likely to affect the budget balance. The estimations have the following form:

$$\frac{BB_{i,t}}{GDP_{i,t}} = \zeta_0 + \zeta_C \quad WageCentralization_{i,t} + \zeta Z_{i,t} + \epsilon_{i,t} \tag{4}$$

The dependent variable is the budget balance (%GDP). $Z_{i,t}$ is the benchmark set of explanatory variables that include:

- Natural resource rent (%GDP) which is a windfall revenue for the government.
- Initial net foreign asset (%GDP) which can increase directly and indirectly the government revenue.
- Cyclical GDP per capita. This variable is measured as the deviation of GDP per capita from its trend (using HP filter) as a ratio to the actual GDP per capita. In recessions, the fiscal deficit is likely to increase due to a decline in tax base and the possibility of expansionary fiscal policy.
- Old dependency ratio. Government is usually engaged in retirement payments. Therefore, old dependency ratio tends to increase fiscal deficits and at the same time reduce the tax base.
- Young dependency ratio. This variable tends to have negative correlation with labor force and, hence, implies lower tax base. Moreover, the government is usually responsible for, at least, some parts of education fees for young people. From the two channels young dependency ratio tends to have negative impact on fiscal deficits.

All the data are measured as level. The sources and descriptions of data used in the regressions are reported in table 6. I estimate equation (4) using 5-year, 4-year, 3-year av-

erages of data and also for annual data. The results which are reported in table 2, confirm the positive and significant impact of wage centralization on budget balance. The impacts of per capita GDP deviation, natural resource rent and net foreign assets are significant and consistent with theory. The impact of young dependency ratio is significant only for annual data. Our estimation does not identify any relationship between old dependency ratio and fiscal balance.

Table 2: Panel Regression for Budget Balance

Dependent variable: Budget balance (%GDP)	5-year averages	4-year averages	3-year averages	Annual data
Iverson index	8.247***	8.968***	7.098***	6.526**
	(2.838)	(2.976)	(2.644)	(2.810)
Natural resource rent (%GDP)	0.602***	0.637***	0.640***	0.658***
	(0.118)	(0.120)	(0.104)	(0.083)
Net foreign asset (%GDP)	0.026***	0.032***	0.023***	0.022***
	(0.010)	(0.010)	(0.008)	(0.007)
GDP deviation	14.015	24.887***	11.819**	6.506***
	(12.053)	(9.539)	(5.268)	(2.273)
Dependency ratio (old)	0.042	0.018	-0.040	-0.110
	(0.115)	(0.113)	(0.098)	(0.077)
Dependency ratio (young)	0.104	0.001	-0.075	-0.201***
	(0.133)	(0.116)	(0.097)	(0.070)
Constant	-9.671*	-6.606	-2.646	2.591
	(5.615)	(5.281)	(4.495)	(3.471)
Rsquared	0.47	0.51	0.45	0.39
Observations	90	117	158	433

Standard errors are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

The main result from this subsection is that wage centralization has positive and significant impact on budget balance. Adding this to the results for the validity of the twin deficit hypothesis in the previous subsection implies that wage centralization can reduce the deficit in external balance by improving the budget balance position. Moreover, the results on the robust and positive impact of wage centralization on current account demonstrate that the impact of wage centralization on current account through the budget balance is not offset (at least completely) through other possible mechanisms. However, there is still the possibility that wage centralization improves current account through other channels as well. One other possible explanation for the positive relation between wage centralization and current account is the possible negative impact of wage centralization on inequality. [19] In appendix B, I reexamine the inequality-current account hypothesis introduced by Kumhof et al. (2012). Besides, I examine whether wage centralization can reduce inequality. The findings confirm negative association between wage centralization and income inequality, on the one hand, and negative association between inequality and current account, on the other.

4.3 Wage centralization and households saving rate

Another interesting and related study is to test the relationship between wage centralization and households savings. According to existing theories and the findings of this paper, two opposite relations between the two variables are expected. First, the positive impact of wage centralization on public saving can crowd out households savings through Ricardian effect. Second, wage centralization can improve households savings through reducing personal income inequality, since inequality is expected to go hand in hand with lower households savings (Behringer et al. (2013)). To test the aggregate impact of wage centralization on households saving, I test the following specifications for 3-years and 5-year averages of data:

$$HSR_{i,t} = \alpha_0 + \alpha_I \quad IncomeInequality_{i,t} + \alpha_B \quad BudgetBalance_{i,t} + \alpha X_{i,t} + \epsilon_{i,t} \tag{5}$$

$$HSR_{i,t} = \alpha_0 + \alpha_C \quad wageCentralization_{i,t} + \alpha X_{i,t} + \epsilon_{i,t} \tag{6}$$

Estimation of equation (5) is inspired by Behringer et al. (2013). The dependent variable in both estimations is households saving rate. The data for this variable is taken from AMECO except for Canada and Australia for which the data is from OECD. $X_{i,t}$ is the

[19] This possible explanation, if it holds, must be understood as a complementary rather than rival/alternative explanation for the mechanism of this paper, since the results from the previous and this subsections support the hypothesis that there is a link between wage centralization and current account through the budget balance.

same set of explanatory variables which is used for estimation of current account.[20] All the variables are expected to have the same sign as in current account regressions with the exception of budget balance that is expected to reduce private saving through the Ricardian effect. To test the impact of wage centralization on households private saving, I substitute this variable for budget balance and inequality. The results for 3-year and 5-year averages of data are reported in table 14 for demeaned measurements of the data. The estimations are performed with and without controlling for country-fixed-effects. The results suggest that both inequality and budget balance tend to reduce households private saving. However, wage centralization has no impact on household saving rate. This result can be explained by the opposite impact of wage centralization on budget balance and inequality. Therefore, the positive impact of wage centralization on private saving through inequality and its negative impact through improving the budget balance partially offset each other.

To summarize, my empirical analyses suggest that wage centralization tends to improve current accounts in the cross-section of industrial economies. The results show that this impact is mostly through improving budget balance: wage centralization has positive and significant impact on public saving but no significant impact is identified on households saving rate. The empirical findings also confirms the negative impact of income inequality (expressed as top income share) on personal saving and, hence, on current account as suggested by Kumhof et al. (2012) and Behringer et al. (2013).[21] I also showed evidence that wage centralization tends to reduce inequality. Considering these two latter linkages together, wage centralization has two opposite impacts on households savings: it can increase private saving by reducing inequality and it can reduce households savings by improving public saving (Ricardian effect). In the following section, I provide a theoretical model to explain the finding that wage centralization can improve the current account through its positive impact on public saving.

[20] The rationale is that, in principle, this set of explanatory variables tend to affect the current account through households savings.

[21] No evidence is found for inequality-households saving and for inequality-current account relationships the data are measured with no-cross-sectional demeaning and when Denmark, Norway and Finland are added to the list of the countries that are used by these authors. Once these three countries are excluded from the sample, the results confirm these linkages even with level-data measurement. Nevertheless with cross-sectional demeaned data, the two linkages are always confirmed.

5 Theoretical model

5.1 A short description of the model

The model uses a political economy framework in which the policy maker follows preferences of N-sector workers which constitute the majority. It incorporates a small open economy with two sectors: T-sector and N-sector. The labor market is characterized by search and match friction. The government provides public goods financed through lumps-sum tax, external borrowing and return on foreign assets. The public good is built from a combination of the two goods. Private agents neither save nor borrow. Therefore, the budget deficit is equal to the current account and gives the magnitude of foreign capital inflows.

Running a budget deficit implies an increase in the amount of public good and a real exchange rate appreciation: an increase in the relative price of the N-sector good. As search frictions severely constrain between-sector labor mobility, the relative wage of workers in the N-sector goes up. Therefore workers in this sector support relatively more such twin-deficit policies since they enjoy higher provision of public goods and, at the same time, an increase in their wage. Conversely, workers in the T-sector lose on their real wage due to the loss in international competitiveness of their sector.

The magnitude of these effects decreases with the degree of wage centralization. Unions promote wage equality. When wages are set at national level, wage inequality between sectors is reduced. More importantly, the sensitivity of sector-specific wages to changes in relative prices is lowered when the wage is more centralized. Thus, the gains and losses from twin-deficit policies are smaller.

To demonstrate this mechanism, the paper runs a numerical experiment. It assumes there is a positive shock on the current amount of foreign assets. The government spreads this additional resource over time so as to maximize the expected utility of a typical worker employed in the N-sector. The model shows that the policy maker is more patient in consuming the realized/expected increase in the valuation of its foreign assets if the wage bargaining is more centralized. Consequently, the model concludes that the magnitude of the current account deficit decreases with the degree of wage centralization.

5.2 Households

The households' utility depends on their private consumption (c_i) and public good provision (G) provided by the government:

$$u_i(c_i, G) = c_i + f(G) = c_i + z_1 G^{z_2} \tag{7}$$

I assume that the households are risk neutral with respect to their private consumption. This assumption rules out the possibility of private saving and simplifies the model. In fact, private saving is, indeed, an important component of current account and accordingly, this assumption must be justified. In subsection 7.1, I discuss the rational and validity of this assumption.

Following the literature on the Dutch disease, I assume that the basket of private consumption consists of final goods from the T-sector and the N-sector.

$$C_i(c_{i,T}, c_{i,N}) = c_{i,T}^{\gamma} c_{i,N}^{1-\gamma} \tag{8}$$

Given the sectoral prices, the household i decides about the optimal allocation of its consumption between the two sectors to minimize its cost for the given level of consumption:

$$\begin{aligned} &\min P_N c_{i,N} + P_T c_{i,T} \\ &\textbf{s.t. } c_{i,T}^{\gamma} c_{i,N}^{1-\gamma} = C_i \end{aligned}$$

Tradeable price is set as numeraire ($P_T = 1$). The household's static cost minimization problem leads to the following relation between its consumption share of each sector and the real exchange rate (relative price of the N-sector to the T-sector):

$$e = \frac{P_N}{P_T} = \frac{(1-\gamma) c_{i,T}}{\gamma c_{i,N}} \tag{9}$$

where e represents real exchange rate. An increase in the relative price of one sector makes the household to substitute its consumption toward the other sector. Since the private consumption is homogeneous of degree one with respect to sectoral consumption, equation (9) leads to the following relation between the aggregate private demands for each sector and the real exchange rate:

$$e = \frac{P_N}{P_T} = \frac{(1-\gamma) C_T}{\gamma C_N} \tag{10}$$

5.3 Government

Government expenditure consists of constant unemployment benefit (b) and provision of public good (G_t). Government finances its expenditure by (i) lump-sum tax (τ_t) levied on employed households, (ii) gross return on its foreign assets and (iii) borrowing from international financial markets. τ_t, G_t and b are in terms of the domestic price level.[22] Therefore, government budget constraint is of the following form:

$$G_t + bu_t = \tau_t \bar{n}_t + r\frac{A_{t-1}}{\bar{P}_t} + \frac{A_{t-1} - A_t}{\bar{P}_t} \tag{11}$$

A_t represents the net foreign assets owned by the government. This variable is in terms of the T-sector price level which is internationally fixed. $\frac{A_{t-1}-A_t}{\bar{P}_t}$ is the government net borrowing or fiscal deficit and $\frac{rA_{t-1}}{\bar{P}_t}$ is the net return on foreign assets.

I define $B_t(= (1+r)A_{t-1} - A_t)$ as ***windfall expenditure***: the part of the government expenditure which is financed through borrowing or by the return on its foreign assets.[23] In other words, windfall expenditure is public budget deficit plus the net return on its assets. Using this definition, we can rewrite the public budget constraint in the following form:

$$G_t + bu_t = \tau_t \bar{n}_t + \frac{B_t}{\bar{P}_t} \tag{12}$$

Public good provision:

To produce public service/goods, the government must buy tradable and non-tradable final goods from the market and combine them with no cost. For the sake of simplicity, I assume that the share of T-sector and N-sector goods are the same in public good provision as in the basket of private good (γ):[24]

$$G(g_T, g_N) = g_T^{\gamma} g_N^{1-\gamma}$$

The government minimizes its cost for a given level of public expenditure:

$$\begin{aligned} &\min P_{N,t} g_{N,t} + P_{T,t} g_{T,t} \\ &\textbf{s.t. } g_{T,t}^{\gamma} g_{N,t}^{1-\gamma} = G_t \end{aligned}$$

This minimization problem together with equation (9), lead to the following relationship

[22] Assuming lump-sum tax instead of linear or progressive taxes simplifies the model and, besides, rules out the distortionary impact of the other alternative tax forms.

[23] Notice that if $A_{t-1} > A_t$, the government finances partially its expenditure by borrowing.

[24] The impact of different intensities is discussed in discussion.

between the sectoral aggregate demands and the real exchange rate:

$$e = \frac{P_N}{P_T} = \frac{(1-\gamma)(C_T + g_T)}{\gamma(C_N + g_N)} \tag{13}$$

We can also find the domestic price level in terms of the price of the T-sector (set as numeraire):

$$\bar{P} = \frac{1}{(1-\gamma)^{(1-\gamma)}\gamma^{\gamma}} P_N^{1-\gamma} \tag{14}$$

Equation (14) implies that appreciation of real exchange rate leads to an increase in the aggregate price level in terms of international price level (or equivalently a decline in T-sector price in terms of domestic price level).

5.4 Market clearing

Market clearing implies that the total expenditure (private and public) equals the total revenue (production rent and the net return on the government's foreign assets) plus the national net borrowing ($A_{t-1} - A_t$) which is the budget deficit.[25]

$$\bar{P}_t C_t + \bar{P}_t G_t = Y_{T,t} + P_{N,t} Y_{N,t} + ((1+r)A_{t-1} - A_t) = Y_{T,t} + P_{N,t} Y_{N,t} + B_t \tag{15}$$

By definition, the aggregate consumption of N-sector final goods is equal to the production in this sector:

$$(c_N + g_N) = Y_N \tag{16}$$

Equations (15) and (16) imply that windfall expenditure corresponds to trade deficit:

$$B_t = Y_{T,t} - (c_{T,t} + g_{T,t}) \tag{17}$$

Therefore, we can, equivalently, interpret B_t as current account deficit plus the net return on net foreign assets owned by the government.

Definition 1. *I define* **windfall expenditure** *as net borrowing plus the net return to*

[25] This is due to the fact that in this model households do not save and, hence, they do not save/dissave in international financial market.

foreign assets: $B_t(=(1+r)A_{t-1}-A_t)$. *Since individual households do not have access to international financial market, we have:*

$$\textit{Current Account deficit} = \textit{Budget deficit} \ = B_t - rA_{t-1} = A_{t-1} - A_t$$

Consequently, for a given deficit in trade balance, the higher is the government's initial net foreign asset, the lower would be the deficits in current account and in budget balance. Substituting equations (16) and (17) into equation (13), one can find the relative price of N-sector to T-sector (real exchange rate) as follows:

$$e_t = P_{N,t} = \frac{(1-\gamma)(Y_{T,t}+B_t)}{\gamma(Y_{N,t})} = \frac{(1-\gamma)(a_T n_{T,t}+B_t)}{\gamma a_N n_{N,t}} \tag{18}$$

This equation expresses an important symptom of the Dutch disease phenomenon: if production factors can not be immediately reallocated between the sectors, e.g. if there is friction in labor market, an increase in windfall expenditure leads to a real appreciation of currency. In other words, a positive shock in external borrowing, international interest rate (for the net creditors), or in the value of foreign asset brings about an appreciation of real exchange rate in short term. In the next subsection, I introduce the production side of the economy which is characterized by match friction in the labor market.

5.5 Production side and labor market

Production in any active firm depends linearly on labor. Each household is either unemployed or employed in one of the two sectors. If unemployed, he searches for a job in both sectors and he receives a constant and exogenous unemployment benefit *(b)*. If employed, he earns the real wage of w_j which depends on his sectoral affiliation *(j)*. When vacant, the firms in each sector search for workers with real cost *(c)*. When the job is active and matched with a worker, the firms produce final goods and enjoy the profit. Search is segmented: firms who search for jobs in one sector do not create congestion effect for the searching firms in the other sector.The matching process in each sector is governed by Cobb-Douglas function and depends on the unemployment rate *(u)* and the number of vacancies in that sector *(ν_j)*:

$$M_j = \phi \nu_j^{1-\alpha} u^{\alpha} \qquad \text{for } j \in \{T, N\} \tag{19}$$

where ϕ is the efficiency of matching function. Equation (19) gives the number of matches

in each sector and in each unit of time. Therefore, the probability that a vacant firm in sector j meets a worker, (p_j^f), and the probability that an unemployed household meets a vacancy in sector j, (p_j^w) are respectively:

$$p_j^f = \phi(\frac{u}{\nu_j})^{\alpha} \quad , \quad p_j^w = \phi(\frac{\nu_j}{u})^{1-\alpha} \qquad \text{for } j \in \{T, N\} \tag{20}$$

Since households can search for jobs in both sectors, there is the possibility of $p_T^w p_N^w$ that a worker finds a job in both sectors. In this case with probability of 0.5 he will be employed in one of the two sectors. Therefore, the probability that a vacant firm in sector j matches with a worker, (q_j), and the probability that an unemployed household can find a job in sector j, (ρ_j), can be found by the following equations:

$$q_j = p_j^f - 0,5 p_{-j}^w \quad , \quad \rho_j = p_j^w - 0,5 p_j^w p_{-j}^w \qquad \text{for } j \in \{T, N\} \tag{21}$$

Moreover, in each period of time, an active job can be destroyed with the exogenous probability of χ. Therefore, the evolution of employment in each sector can be expressed by the following equations:

$$n'_j = \rho_j u + (1 - \chi) n_j \quad \text{for } j \in \{T, N\} \tag{22}$$

In equation (22), n_j represents the number of workers in sector j. To open a vacancy and search for workers, the firms must pay the real cost c. Therefore, the value function of opening a vacancy in sector j is:

$$V_j = -c + \beta(q_j J'_j + (1 - q_j) V' j) \tag{23}$$

where $J'_{o,j}$ is the next period value function of the employer in sector j and β is the subjective discount rate of the households. The value function of active employers in sector j can be represented by the following equations:

$$J_j = \frac{a_j P_j}{\bar{P}} - \omega_{e,j} + \beta E\Big[(1 - \chi) J'_j + \chi V'_j\Big] \tag{24}$$

In (24), a_j and ω_j are sector-specific technology level, which is assumed to be given and constant, and wage in terms of domestic price level. P_j and $\bar{P}$ represent the price of the final goods in sector j and the domestic price level, respectively. Accordingly, the value functions

of the workers in sector j is:

$$W_j = \omega_{e,j} - \tau + \beta E\Big[(1-\chi)W'_j + \chi W'_u\Big] \tag{25}$$

where W'_u is the next period value function of unemployed households. This value function can be expressed by the following equation:

$$W_u = b + \beta E\Big[\rho_T W'_T + \rho_N W'_N + (1-\rho_T-\rho_N)W'_u\Big] \tag{26}$$

Free entry condition implies that the value function of vacancy creation is zero:

$$V_j = 0 \Rightarrow J'_j = \frac{c}{\beta q_j} \tag{27}$$

Using free entry condition, we can write the evolution of vacancy (24) in the following form:

$$\frac{c}{\beta q_j} = \frac{a_j p'_j}{\bar{P}'} - \omega'_j + \frac{c(1-\chi)}{q'_j} \tag{28}$$

This equation demonstrates another symptom of the Dutch disease phenomenon: the resource effect. Expecting a positive shock in real exchange rate induces higher (lower) vacancy creation in the N-sector (T-sector). Consequently, the model implies that an increase in the windfall expenditure leads to a reallocation of resources from the T-sector to the N-sector.

5.5.1 Wage setting

As explained before, the main role of wage centralization in this model is reducing inter-sectoral wage gap and hence, reducing the flexibility of wages with respect to sector-prices.[26] [27] To capture this impact of wage centralization, I assume that there exist two wage bargaining levels in the economy: (i) bargaining at central level which is the outcome of horizontal coordination between sector-level unions, and (ii) bargaining at firm level. The objective of the central-level bargaining is to set an egalitarian wage for all the workers ($\bar{\omega}$) independent from their sector affiliation. [28] At firm level, wage (W_j^d) is set by bargaining between

[26] In discussion, implications of the impact of wage centralization on reducing the intra-sectoral wage gap is discussed.

[27] For the impact of wage centralization on reducing inter-sectoral wage gaps and reducing the responsiveness of sectoral wages to sectoral prices see: Rycx (2002); Kahn (1998); Blau and Kahn (1999); Edin and Zetterberg (1992)). Holmlund and Zetterberg (1991), Hartog et al. (2002) and Teulings and Hartog (1998)

[28] The motivation of the union to compress the wage dispersion can be based on its egalitarian criteria or its objective for insuring the workers against the volatility in sectoral prices and productivity.

individual employee and firm. The market wages are the outcome of vertical coordination between these two levels of bargaining. This vertical coordination is directed at passing down the results obtained at a central level ($\bar{\omega}$) to firm level (Moene et al. 1993). The ability of central organization to pass its bargaining result to firm level determines the level of wage centralization. More formally:

$$\omega_j = (1 - \sigma^C)\omega_j^d + \sigma^C \bar{\omega} \quad j \in \{T, N\} \tag{29}$$

where σ^C, defined between zero and one, represents the level of wage centralization. If the central organizations have perfectly dominant positions ($\sigma^C = 1$) and can perfectly enforce their egalitarian objective the wage would be $\bar{\omega}$ for all the workers. Conversely, if wage bargaining is completely decentralized ($\sigma^C = 0$), the wage (ω_j^d) would be the outcome of firm-level. This wage setting structure is similar to Boeri and Burda (2009),[29] which argues that the wage rate for a worker depends, on the one hand, on the productivity of his job (here, his sectoral productivity) and, on the other hand, on some egalitarian criteria which is enforced by the union.

I assume that wage centralization does not affect the aggregate share of workers from the total economic rent. In other words, central organizations attempt to reduce the intersectoral wage dispersion only by transferring some rents from high-paid to low-paid workers.[30] More formally:

$$\sum_j n_j \omega_j = \sum_j n_j \omega_j^d \tag{30}$$

Following Mortensen and Pissarides (1999a), Mortensen and Pissarides (1999b), Mortensen and Pissarides (1999c) and Pissarides (2000), decentralized wages (ω_j^d) is determined according to Nash bargaining between individual employer and worker. We assume the bargaining power of individual workers to be η. Therefore:

$$W_j^d - W_u = \frac{\eta}{1 - \eta} J_j^d \quad j \in \{T, N\} \tag{31}$$

This leads us to the determination of hypothetical decentralized wage which is standard

[29] The model in this paper is the most similar to my model in terms of definition and expression of wage centralization.

[30] The impact of wage centralization on current account through its impact on wage level can be an interesting subject for future studies. This channel is briefly discussed in section 3.

in the literature:

$$\omega_j^d = \eta\frac{a_j P_j}{\bar{P}} + (1-\eta)(\tau+b) + \eta\beta E\Big[\rho_T(W'_T - W'_u) + \rho_N(W'_N - W'_u)\Big] \quad \text{for:} \quad j \in \{T, N\}. \tag{32}$$

Equation (32) demonstrates that the decentralized wage in each sector is an increasing function of the price in that sector. Moreover, it implies that, the only source of wage disparity in the model is sectoral prices (and sectoral technology level which is considered to be exogenous and constant). Recall that the aggregate price level $\bar{P}$ is an increasing function of real exchange rate (P_N) and P_T is set as numeraire. Therefore, a positive shock in N-sector price level induces an increase (a decrease) in hypothetical decentralized wage of N-sector (T-sector) workers. Using equations (29) (32) and (30), one can show the market wage in the following form:

$$\omega_j = \omega_{e,j}^d - \eta\sigma^C \frac{n_{-j}}{n_j + n_{-j}}\left(\frac{a_j P_j}{\bar{P}} - \frac{a_{-j} P_{-j}}{\bar{P}}\right) \qquad j \in \{T, N\} \tag{33}$$

This equation demonstrates that if wage is completely decentralized ($\sigma^C = 0$), workers earn their corresponding decentralized wage and if the wage is perfectly centralized ($\sigma^C = 1$), workers, regardless of their job affiliation earn the average wage of the economy. Finally, equation (33) implies that the higher is the degree of wage centralization, the lower is the responsiveness of wage with respect to the corresponding sector productivity.

5.6 General equilibrium

Now we can define the dynamic general equilibrium of the model. For a given time profile of windfall expenditure B_t, the dynamic general equilibrium can be defined such that:

- Households consume all their revenue from net wage (if employed) and unemployment benefit (if unemployed).
- Given relative prices, households and government allocate their expenditure between T-sector and N-sector.
- Free entry condition holds (equation (28)).
- Wages depend on the bargaining between employers and workers and also the level of wage bargaining (equations (33)).
- Government budget constraint holds (equation (12)).

- Market clears (equation (18)).
- Employment in each sector depends on matching function, the characteristics of the labor market and sectoral wages and prices (equations (22), (19), (21)).

Accordingly, the following set of equations determines the dynamic general equilibrium of the model for a given time profile of windfall expenditure $\{B_t\}$: For $j \in \{T, N\}$, this system leads to 12 equations with 12 unknowns: $\{q_T, q_N, \rho_T, \rho_N, \nu_T, \nu_N, \omega_T, \omega_N, P_N, n_T, n_N, n, \tau\}$.

6 Numerical analysis

In order to illustrate the mechanism explained in the previous section, in this section, I perform a numerical example. First, I calibrate the model (subsection 6.1). Then, in subsection 6.2, I examine the macroeconomic effects of a shock in windfall expenditure. In subsection 6.3, I show how workers in different sectors have different policy preferences when a shock in public foreign assets is realized.

6.1 Model calibration

In this subsection, I introduce the calibration of the model for a numerical example which illustrates the mechanism of the model. It is worthwhile to mention that the only variables which are qualitatively sensitive to the calibration are unemployment and tax. However, these variables are not the main concerns of this paper and, moreover, the impact of the shock on these variables are in second order with respect to the variables of our interest.

Matching and the labor market

den Haan et al. (2000) set the steady state separation rate (χ) equal to 0,1. This calibration is based on Hall et al. (1995) conclusion that around 8 to 10 percent of workers separate from their jobs each quarter. Merz (1995) and Andolfatto (1996) find the quarter separation rate equal to 7% and 15% respectively. I set the *monthly* separation rate equal to 0,03 to correspond approximately to the average of these studies. Following den Haan et al. (2000) and others, the bargaining power of workers is set to 0,5. Unemployment benefit (b) is set to be 13% of the steady state wage rate in the N-sector. The cost of opening a vacancy (c) is set to be equal to steady state minimum wage. To obtain the average unemployment rate of OECD countries in 2014 (0.08), the level parameter of matching function (ϕ) is set to 0,077.

Utility function

To neutralize the effect of initial level of windfall income, I assume that the utility of households is linear in public good ($z_2 = 1$). Yet, any choice of $0 < z_2 < 1$ will not affect the qualitative results of this paper. Linearity of utility function with respect to its two components assures us that the steady state value of public expenditure has no impact on the results. I set steady state value of windfall income equal to around the average of the US trade deficit (relative to GDP) in the last 5 years before 2000. This value is 1.2% of steady state GDP. I assume that the government maximizes the utility of households when deciding about its expenditure. Therefore, marginal utility of private consumption and public good are the same, i.e. $z_1 = 1$. In the following section, I discuss the impact of different levels of z_1 on the households value function. To capture the fact that the majority of workers are engaged in the N-sector, I assume the consumption share of the T-sector (γ) to be 0.3. The monthly discount rate is set as 0.9947. Monthly interest rate is set equal to 0,042 % which corresponds to annual interest rate of 0.5 %.

Production function

I normalize the T-sectoral technology level to unity ($a_T = 1$). Data from OECD shows that the averaged productivity ratio between industry sector and service sector is around 1,3. Accordingly I assume ($a_N = 1.3$). The calibrated parameters are reported in table 3.

6.2 Effects of a shock in the windfall expenditure

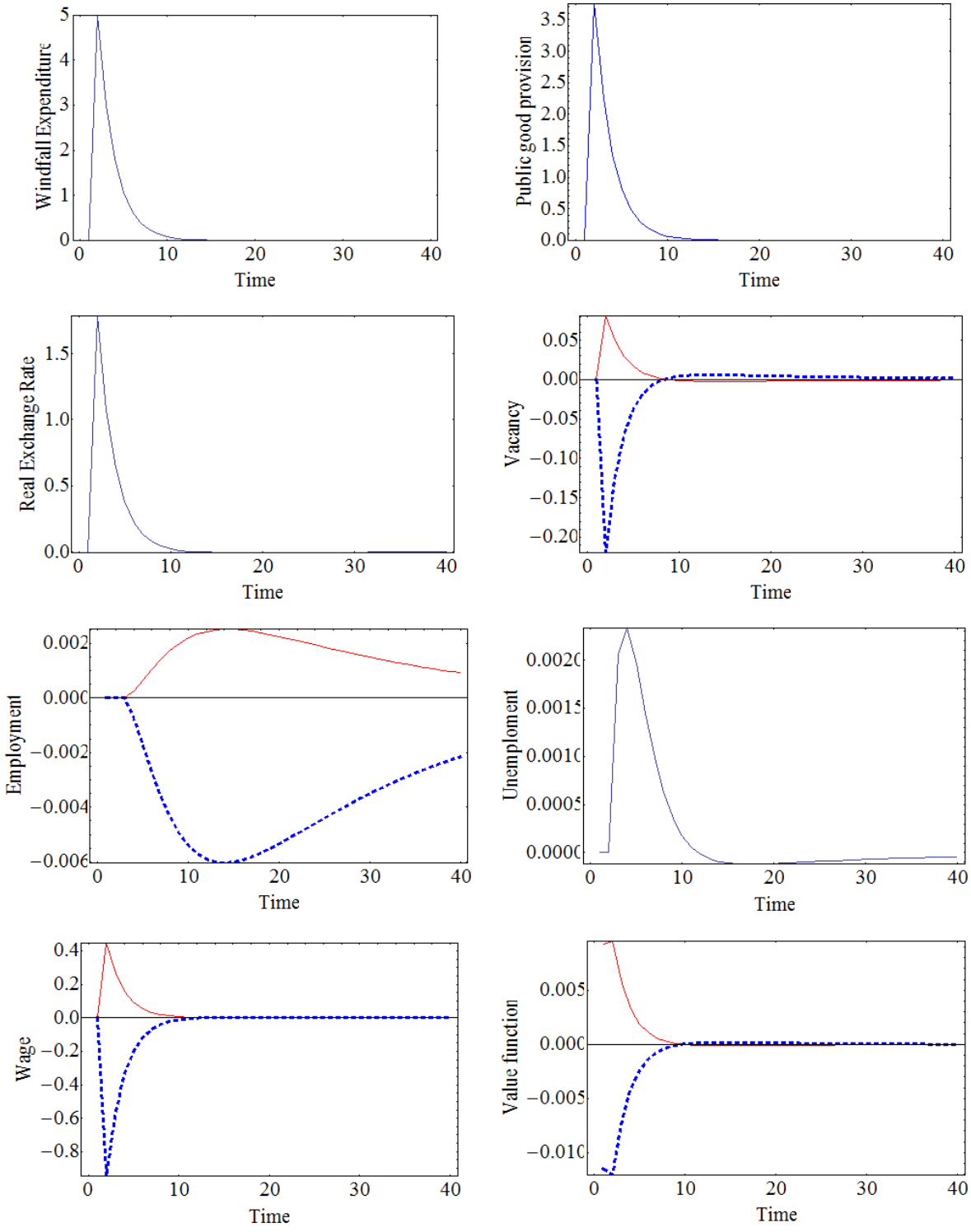
Macroeconomic impacts of a shock in windfall expenditure.

A positive shock in the windfall expenditure (B_t) leads to an increase in the public demand and, thus, in the aggregate demand for final goods in both sectors (equation (15)). More demand in the T-sector increases the import from abroad leading to deterioration of trade deficit (equation (17)). However, by definition, the supply of the N-sector final goods cannot increase immediately (equation (16)). Consequently, the positive shock in the windfall expenditure leads to an appreciation in the real exchange rate: an increase in the relative prices of the N-sector to the T-sector (equation (18)).

Real appreciation of currency increases (decreases) the economic surplus of matches in the N-sector (T-sector). Consequently, more vacancy will be created in the N-sector (T-sector) (equation (28)). Correspondingly, employment increases in the N-sector and decreases in the T-sector. During the transition period, N-sector workers, while enjoying a higher provi-

Table 3: Calibrated parameters

Symbol	Value	Interpretation	Source/Target
χ	0,03	Exogenous separation rate	To target approximate quarterly separation of 10-11 %
α	0,5	Curvature parameter of matching function	
c	0,25	Cost of vacancy	
b	0,03	Unemployment benefit	13% of N-sector steady-state wage
ϕ	0,077	Level parameter of matching function	To obtain unemployment equal to 8%
η	0,5	Workers' bargaining power	Following den Haan et al. (2000) and others
γ	0,2	Consumption Share of the T-sector	To obtain N-sector empl. share equal to 0,85 (US in 2000)
β	0,9947	Monthly discount rate	standard
r	0,16 %	Monthly interest rate	U.S. 2015 (wold bank)
z_1	0,1	Weight of public good in utility	Same marginal utility for C and G
z_2	1	Concavity of utility with respect to public good	Linear utility with respect to G
a_T	1.3	Technology level in the T-sector	Av. productivity ratio between industry and service sector (OECD)
a_N	1	Technology level in the N-sector	Normalization
B_{ss}	0.05	Steady state Windfall expenditure	3.5% of S.S. GDP corresponding to 2012 trade deficit in US



Solid line and dashed line correspond to N-sector and T-sector respectively.

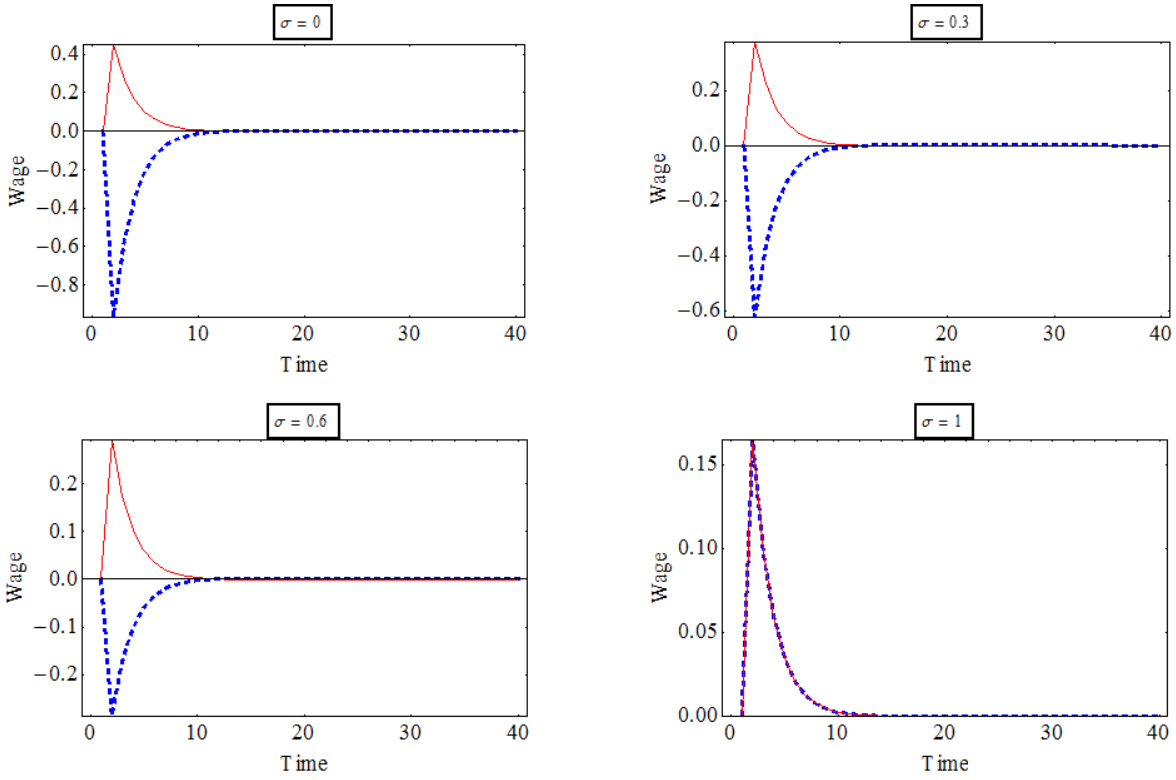
Figure 3: Macroeconomic impacts of a positive shock in windfall expenditure.

sion of public good, benefit from a higher wage. T-sectors workers, however benefit from a higher provision of public good only at the cost of decline in their wage and, thus, in their

private consumption (equation (32)).[31] These results are depicted in figure 3. The impacts on sectoral employment rates and on sectoral wages are completely opposite if a negative shock in windfall expenditure is realized.

Effect of wage centralization.

As discussed before, a higher degree of wage centralization reduces wage dispersion between the two sectors by transferring some rents from the sector with higher wages to the sector with lower wages. Consequently, σ^C will decrease the sensitivity of sectoral wages with respect to variations in real exchange rate induced by the windfall shock. Figure 4 demonstrates sectoral wage responses to the same windfall shock. As it is clear from this figure, when $\sigma^C = 1$, windfall shock induces no inter-sectoral wage dispersion. Moreover, the wage rise for N-sector workers is smaller when the wage bargaining is more centralized.



Solid and dashed lines correspond to N-sector and T-sector respectively.

Figure 4: Effect of wage centralization on reducing the responsiveness of sectoral wages.

Besides, higher centralization of wage bargaining increases the profit of the booming sec-

[31] The impact of the windfall income on unemployment rate, and so on tax rate, depends on the initial employment shares. Our calibration tries to capture the fact that N-sector workers represent the majority. Since matching function is marginally diminishing in number of vacancy, the windfall shock increases the unemployment. This result would be reversed if T-sector workers were the majority.

tor employers by reducing the wage responses. Consequently, wage centralization intensifies the increase (decrease) in vacancy creation in the booming (failing) sector as a response to the windfall shock. Hence, the reallocation of labor to booming sector is accelerated by wage centralization. Faster reallocation of labors reduces the changes in the real exchange rate. These results are summarized in the following propositions.

Result 1. *If the labor market is frictional, a positive shock in windfall expenditure leads to:*

- *an increase (a decrease) in the wage in N-sector (T-sector). Wage centralization mitigates these impacts.*

The impact of the shock on the households value functions

Using equation (7) and relying on the assumption that the households do not save, we can write the inter-temporal utility of workers and that of the unemployed households as follows:

$$V_j = \big(\omega_{e,j} - \tau + f(G)\big) + \beta E\Big[(1-\chi)V_j' + \chi V_u'\Big] \tag{34}$$

$$V_u = \big(b + f(G)\big) + \beta E\Big[\rho_T V_T' + \rho_N V_N' + (1-\rho_T-\rho_N)V_u'\Big] \tag{35}$$

A shock in the windfall expenditure affects the workers' inter-temporal utility from two different channels: *(i)* the provision of public good (G) and *(ii)* the impact on real wages ω_j.[32] A positive shock in windfall expenditure affects positively the value function of the workers in the N-sector since they will enjoy an increase in wage (and hence, in private consumption) and, at the same time, a higher provision of public goods. Nevertheless, the impact on the value function of workers in the T-sector remains ambiguous since they enjoy a higher provision of public goods only at the cost of a decline in their wage. The fact that which effect dominates depends on the marginal rate of substitution between public goods and private goods (z_1).

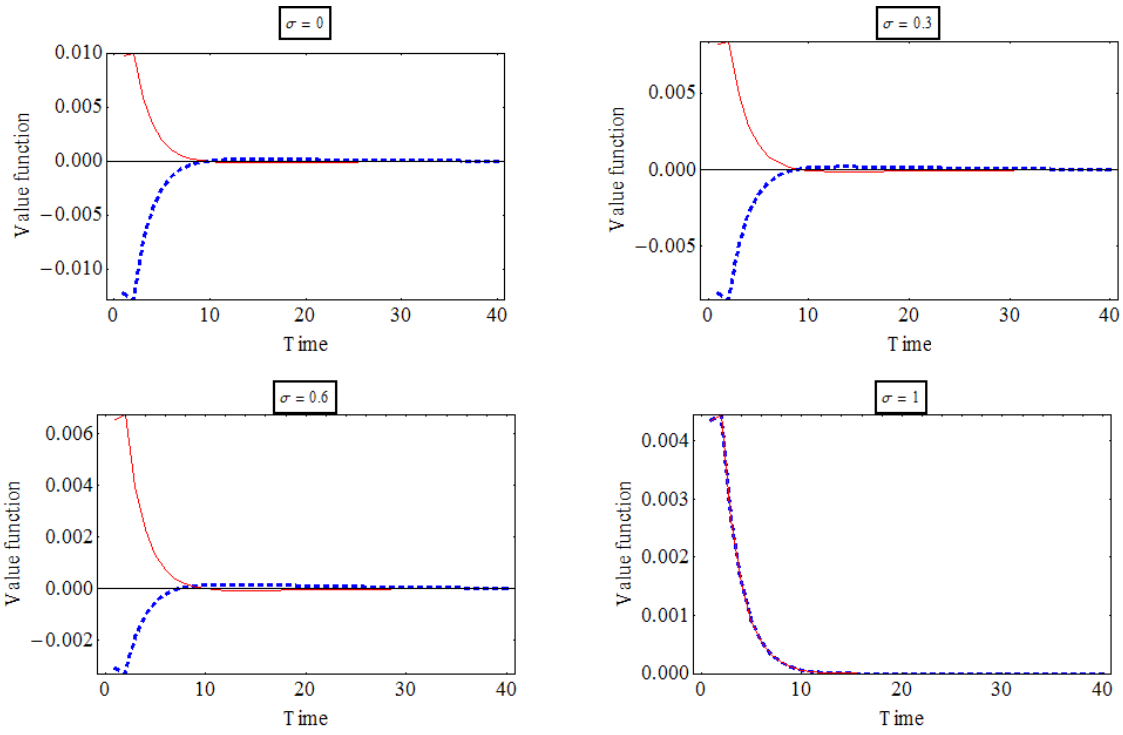
The higher is z_1, the more is the marginal utility of the public goods. Thus, the positive effect of windfall expenditure through the provision of public good dominates its negative impact through the decline in wage (see figure C.1 in Appendix C). The opposite holds when the government reduces its windfall expenditure: Workers in N-sector will lose from lower wage and less provision of public goods, while the workers in the T-sector will enjoy more competitiveness of their sector. These results are embodied in the following proposition:

[32]The impact on the value function of the unemployed households is through public good provision and through the change in probability of finding job in the two sectors (ρ_T and ρ_N). The impact on the value function of the unemployed households is not the interest of this paper and I will not report it henceforth.

Result 2. *If the labor market is frictional,*

- *A positive shock in the windfall expenditure increases the welfare of the N-sector workers by providing them with higher public good provision and higher private consumption.*
- *The impact of the shock on the welfare of the T-sector workers is ambiguous since it provides them with higher public good only at the cost of less private consumption.*

This heterogeneous impact on households' welfare is lessened with wage centralization since it reduces the sectoral wage gap raised by the shock in real exchange rate. Figure 5 depicts the impact of a shock in windfall expenditure on inter-temporal utility of households for the case of $z_1 = 0.1$ and for the different levels of wage centralization. The figure shows that centralization of wage reduces the gap between the inter-temporal utility of the households affiliated to different sectors. As a matter of fact, the higher is the σ^C, the lower is the welfare gain (loss) for workers in N-sector (T-sector).



Solid line and dashed line correspond to N-sector and T-sector respectively.

Figure 5: Effect of windfall expenditure on the household inter-temporal utility for the different levels of wage centralization.

These results suggest that N-sector workers relatively support more an expansion in the twin deficits and their supports for such policies decreases with wage centralization.

6.3 Policy determination and the twin balances

In this subsection, first, I define the policy; then, I discuss the impact of the policy on households inter-temporal utility. I also evaluate the preferred policy of the households which will depend on their job status. Then, I discuss the effect of wage centralization on households preferred policy. Finally, in subsection 6.3.4, I will explain the policy determination and the effect of wage centralization on endogenous policy determination.

6.3.1 Definition of the policy

At steady state, the windfall expenditure is equal to the net return on foreign assets. Thus, there is no deficit in the two balances at steady state:[33]

$$B_{ss} = rA_{ss} \tag{36}$$

If the government expects a positive shock in the future value of its foreign assets with current amount of $\hat{A}$, it can decide about the time profile of expending this expected shock ($\{B_t\}$) such that the current amount of windfall expenditure equals the current amount of asset shock:

$$\sum_{t=0}[\frac{B_t}{(1+r)^t}] = \sum_{t=0}[\frac{rA_{ss}}{(1+r)^t}] + \hat{A} = (1+r)A_{ss} + \hat{A} \tag{37}$$

Therefore, the policy can be interpreted as the optimal time allocation of the windfall expenditure $\{B_t\}$ such that equation (37) is satisfied. This policy, as it will be made clear in subsection 6.3.4, is chosen through a political economic framework. For the sake of simplicity, I assume that the windfall expenditure follows a Markov process with persistence ρ_B and magnitude $\epsilon_{B,0}$:

$$B_t = B_{ss} + \rho_B^t \epsilon_{B,0} \tag{38}$$

Substituting from equation (38) into equation (37), we have:

$$\sum_{t=0}[\frac{\rho_B^t \epsilon_{B,0}}{(1+r)^t}] = \hat{A} \Rightarrow \epsilon_{B,0} = \frac{1+r-\rho_B}{1+r}\hat{A} \tag{39}$$

Equation (39) which is resulted from the inter-temporal budget constraint of the government, implies that the policy is uni-dimensional. Once the government decides about the shock persistence of its windfall expenditure (ρ_B), its expenditure at time zero and, hence,

[33] Notice that $A_{ss} > (<)0$ implies a deficit (surplus) in trade balance.

in every period of time, will be determined accordingly. When a positive shock in the future value of government foreign assets is realized ($\hat{A} > 0$), the government can increase the provision of public good. In this case, the higher is ρ_B, the more tolerant is the government in increasing its expenditure (i.e. the provision of the public goods) and the smoother will be the provision of public goods (see figure C.2). Consequently, the two balances will be relatively more balanced (more surplus /less deficit). Conversely, the lower is ρ_B as a response to $\hat{A} > 0$, the more intolerant is the government, i.e. it provides more public goods today and less later. The opposite holds if a negative shock in the expected value of foreign assets is realized. In that case, higher ρ_B implies more deficits and a lower ρ_B implies less deficits.

Fact 1. *If a shock in the value of the government's assets ($\hat{A}$) is realized, then:*

- *If $\hat{A} > 0$, higher ρ_B (more smoothing policy) improves the two balances.*
- *If $\hat{A} < 0$, higher ρ_B (more smoothing policy) deteriorates the two balances.*

6.3.2 Effect of smoothing/accelerating policy on the household's value function

To understand better the impact of smoothing policy, I first consider an economy with perfect labor market.

Case of frictionless labor market:

If there were no friction in the labor market, labor forces could have been immediately adjusted to the shock. Consequently, the windfall expenditure would have no effect on the wages or on the private consumption.[34] Therefore, the only consequence of the windfall expenditure would have been to provide the households with higher provision of public good. Moreover, this impact would have been symmetric across the households. Therefore, in that case, the preferred policy would have been the same for all the households: the policy that guarantees the highest present value of the public goods provision. Note that in the case of perfect labor market, domestic price level ($\bar{P}_t$) would have been independent of B_t. This implies that for the case of linear utility with respect to the public goods ($z_2 = 1$) the households, regardless of their job status, will prefer pure smoothing policy ($\rho_B = 1$) if and only

[34]Neutrality of windfall expenditure with respect to the wage, in the case of the perfect labor market, is due to our assumption that the production is linear with respect to the labor factor. If a concave production function is considered, the wages, real exchange rate and the aggregate price level will increase with respect to the T-sector prices. But in any case, the windfall shock would create no gap between the sectoral wages.

if $r > \frac{1-\beta}{\beta}$ and they will prefer pure accelerating policy ($\rho_B = 0$) if and only if $r < \frac{1-\beta}{\beta}$.

Case of frictional labor market

The impact of the windfall shock and, consequently, that of the smoothing policy on the households welfare is more complicated when the labor market is frictional. On the one hand, friction in the labor market implies that windfall shock leads to a real appreciation of currency which can be interpreted as a decline in the value of windfall revenue in terms of domestic price level (since windfall expenditure is in terms of the T-sector price level). This effect implies that the policy that maximizes the current value of the public goods is always greater in the case of a frictional labor market than in the case of a frictionless labor market. For example, for the case of linear utility with respect to public good provision, the policy which would maximize the current value of public good, would not be anymore the binary of $\rho_B = 1$ or $\rho_B = 0$. More precisely, in this case, even if the international interest rate is less than $\frac{1-\beta}{\beta}$, there would exist $\rho_B > 0$ which would maximize the current value of public good provision. The next proposition clarifies this result:

Result 3. *If the labor market is frictional, then there exists* $r_{min} < r_{max} < \frac{1-\beta}{\beta}$ *such that:*

- *If* $r > r_{max}$, $\hat{\rho}_B = 1$ *maximizes the current value of public good provision.*
- *If* $r_{min} < r < r_{max}$, *there exists* $0 < \hat{\rho}_B < 1$ *which maximizes the current value of public good provision.*
- *If* $r < r_{min}$, $\hat{\rho}_B = 0$ *maximizes the current value of public good provision.*

Figure 6 depicted the change in the current value of public good provision (resulted by the shock) as a function of smoothing policy (ρ_B) for ($z_2 = 1$) and prevailing annual international interest rate of 3% (monthly net return of 0.25%). Note that for the calibration of $\beta = 0,9947$ (annual discount rate of $\beta_y = 0,94$, $\rho_B = 0$ would have maximized the current value of the windfall expenditure if the labor market was frictionless. I define $\hat{\rho}_B$ as the policy which maximizes the current value of public good.

On the other hand, as discussed in section (6.2), a positive shock in windfall expenditure increases the wage income of N-sector workers and reduces that of T-sector workers. Therefore, it is clear that the impact of the policy is not symmetric across the workers if the labor market is frictional. If a positive shock in the government's foreign asset is realized, smoothing policy decreases the rise in the current value of expected wage for the workers in the N-sector and it mitigates the loss in the current value of expected wage for the workers

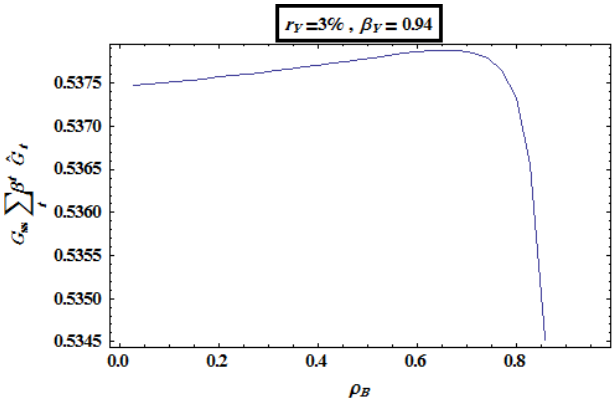


Figure 6: Effect of smoothing policy on the current value of public good provision.

in the T-sector. The reason is that, on the one hand, higher smoothing policy leads to less appreciation of real currency which implies less rise (decline) in the wage of the workers in the N-sector (T-sector). On the other hand, the higher is the ρ_B the more likely it is for the workers in the N-sector (T-sector) to exit from (enter) the booming sector.

The preferred policy by households depends on the impact of policy on both public goods and wage/private consumption. Since the impact on public good is heterogeneous, the workers in the N-sector prefer less smoothing policy than the workers in the T-sector. This result is just due to the heterogeneous impact of the policy on sectoral wages. More precisely, the preferred policy of the workers in the N-sector is smaller than $\hat{\rho}_B$ and that of the T-sector workers is larger than $\hat{\rho}_B$.

Result 4. *When a positive shock in the value of the government's foreign assets is realized, the workers in the N-sector support less smoothing policy than the workers in the T-sector. More precisely, if $\hat{\rho}_B$ represents the policy which maximizes the current value of public good provision, and $\rho_B^{\star,j}$ is the preferred policy of the workers in sector j, then:*

$$\rho_B^{\star,N} < \hat{\rho}_B < \rho^{\star,T} \tag{40}$$

The opposite holds if a negative shock is realized in the government's foreign assets.

6.3.3 Effect of centralization on households' preferred policy

The effect of smoothing policy on the discounted value of N-sector wages is monotonically negative as explained before. Moreover, wage centralization reduces the response of wages to sectoral prices. Figure 7 represents the effect of smoothing policy on the current value of changes in N-sector wages (relative to steady-state value of wage) for different level of wage centralization. While the wage effect of the shock is always decreasing with the policy, its magnitude is lower when wage is more centralized. Nevertheless, wage centralization has no significant impact on $\hat{\rho}$. When wage is decentralized and the wage impact is high, the effect of policy on welfare is dominated by the effect of policy on wage. However, when wage is centralized, the impact on the provision of public good dominates the impact of policy on wage. As a result, the preferred policy of N-sector workers converges to $\hat{\rho}$ when wage centralization is high and so the impact on wage is small. These results are depicted in figure 8 which represents the impact of smoothing policy on the inter-temporal welfare of N-sector workers. When wage is completely decentralized, the effect of smoothing policy is similar to its policy on wage. However, when wage is strongly centralized the effect converges to the impact of the policy on public goods, as the impact on wage is small. Consequently, N-sector worker in a centralized wage economy prefers higher ρ_B which implies less twin deficits.

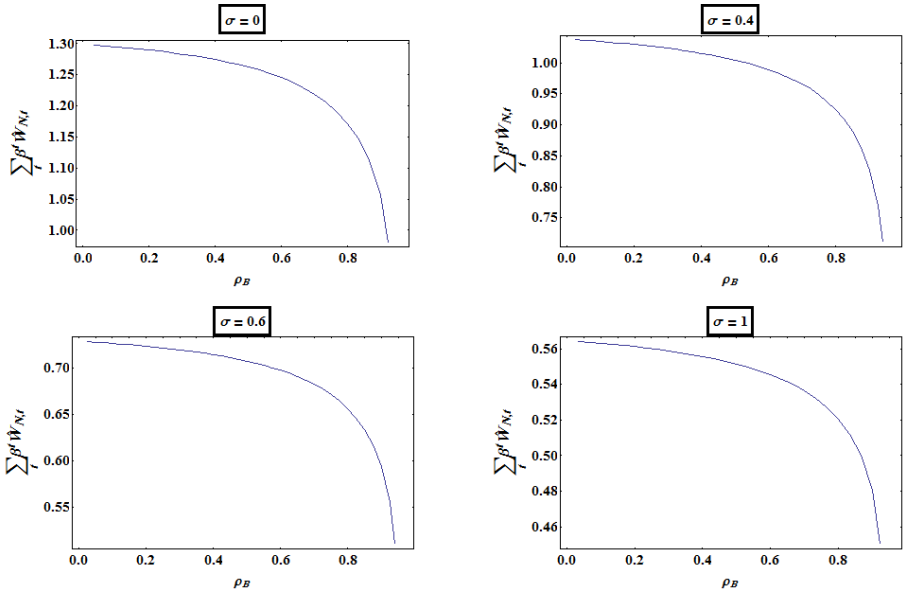


Figure 7: Discounted value of wage changes (% of steady state value) for N-sector workers as a function of smoothing policy for different levels of wage centralization.

Conversely, in decentralized-wage economies, the impact of smoothing policy on T-sector wage rate is positive (see figure C.3). This implies that T-sector workers' preferred policy is higher than $\hat{\rho}$. Again, the higher is the level of wage centralization, the lower is the

impact of the shock on wages (figure C.3). It can be seen that T-sector workers' preferred policy converges to $\hat{\rho}$ when wage is highly centralized. This implies that T-sector workers in more centralized economies prefer less smoothing policy compared to T-sector workers in decentralized-wage economies (see figure C.4). When $\sigma = 1$, both groups of workers have the same evaluation of the policy.

Result 5. *The higher is the centralization of wage bargaining, the more (less) smoothing would be the preferred policy of the incumbent workers in the N-sector (T-sector) when a positive shock in the government's assets is realized. The opposite holds if a negative shock is realized in the government's foreign asset. More formally:*

$$\begin{aligned} \textit{if:}\hat{A} > 0: \quad & \frac{\partial \rho_B^{\star,N}}{\partial \sigma^C} > 0 \quad \frac{\partial \rho_B^{\star,T}}{\partial \sigma^C} < 0 \\ \textit{if:}\hat{A} < 0: \quad & \frac{\partial \rho_B^{\star,N}}{\partial \sigma^C} < 0 \quad \frac{\partial \rho_B^{\star,T}}{\partial \sigma^C} > 0 \end{aligned}$$

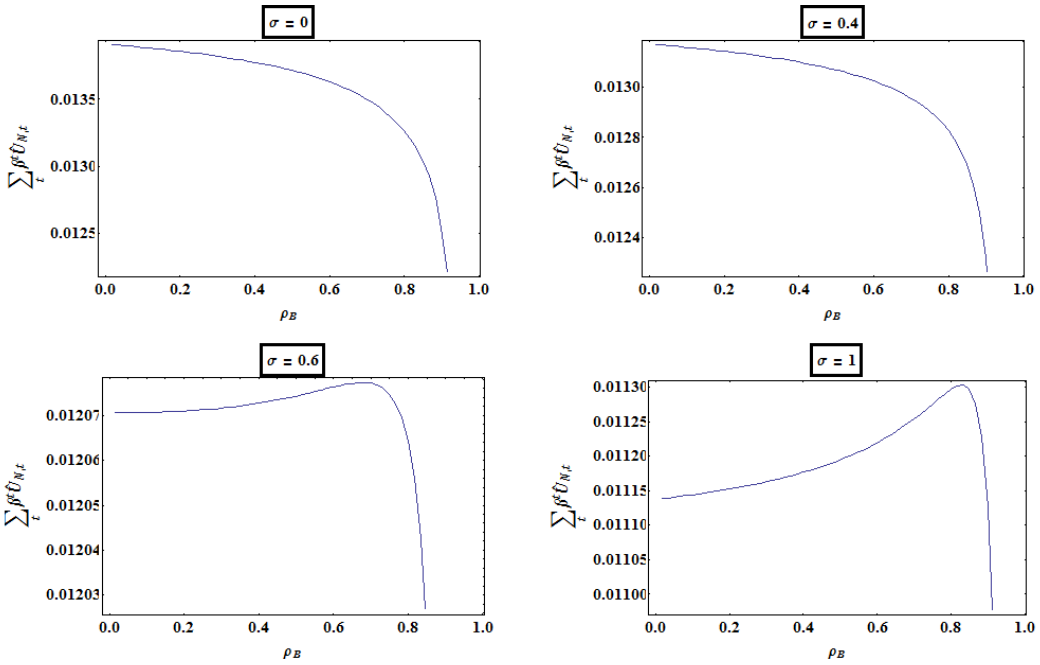


Figure 8: Inter-temporal utility of N-sector workers as a function of policy for different levels of wage centralization.

6.3.4 Policy determination and impact on current account

From political economy point of view, the policy is determined by the majority of households. According to the data from developed countries, majority of workers are affiliated

to the N-sector. Therefore, the policy chosen by the government is likely to represent the preferred policy of the workers in the N-sector.

According to result (5), centralization of wage bargaining pushes the preferred policy of the N-sector workers to be more smoothing. Consequently, this model suggests that in democratic countries where the majority of households decide about the policy, the prevailing policy is more smoothing if the wage bargaining is more centralized.

7 Model discussion

7.1 Discussion on the assumptions for utility function

In the theoretical part of this paper, I rule out the possibility of private saving. This assumption considerably simplifies the model. Yet, private saving is an important component of current account and, therefore this assumption must be justified. The focus of the theoretical part of the paper, is the impact of wage centralization on current account through public saving/expenditure. As long as Ricardian equivalence is not complete, the impact of public saving on current account is not perfectly offset by private dissaving and, therefore, our theoretical results on the impact of wage centralization on current account remain valid qualitatively. The empirical results on current account, including our results in the previous section, point out an incomplete Ricardian equivalence which can justify the qualitative results deduced from this assumption. Moreover, the empirical results of this paper demonstrate that wage centralization has no significant impact on private savings since wage centralization, from another channel, can encourage private saving by reducing personal income inequality. This empirical results can also assure us that assumption on non-Ricardian households will not affect the qualitative results of this paper.

Moreover, I assume additive separable utility function with respect to private and public goods. Relaxing this assumption, if public goods and private consumptions are complementary, an increase in G will increase private saving which intensifies current account deficit. In this case, even an increase in public good provision backed by tax will lead to deterioration of current account through reducing public saving (if households have access to international financial markets). Conversely, if G and C are substitutable, an increase in G motivates the households to save internationally. Hence, the impact of the budget deficit on current account will be moderated.

7.2 Intra-sectoral wage compression

In the theoretical part of this paper, I argued that wage centralization affects the political incentive of the government in managing its budget balance, and so the current account, by reducing the inter-sectoral wage dispersion. Here, I discuss that wage centralization can have similar impact on the two balances if it reduces intra-sectoral wage dispersions as long as they are resulted by job-specific or sector-specific human capital. Job-specific human capital can be accumulated by workers through job seniority (Topel (1990), Becker (2009)) and by the investment of employers on the job-specific skills of the workers (Acemoglu and Pischke (1998)).[35] Therefore, job seniority can increase wages for workers with more job seniority. On the other hand, wage centralization can reduce the wage gap between the workers with different individual human capital/efficiency (See for example Cahuc and Zylberberg (2004) and Wallerstein (1999)). Combining these two impacts, one can deduce that wage centralization reduces the wage gap between the workers with different job seniority.

If a positive shock in the twin deficits is realized, workers will be reallocated from the T-sector to the N-sector. The new matched workers in the N-sector have relatively less job-seniority and, hence, less sector-specific human capital. Consequently, the proportion of low-skilled to high-skilled workers will increase in the N-sector. If wage centralization reduces the gap between high skilled and low skilled workers by rent sharing between the two groups of workers, incumbent workers in the N-sector will realize relatively less wage rise compared to the case where wages are less centralized. This reduces their thirst for such twin deficits policy. Correspondingly, the government following preferences of workers in the N-sector will find less political incentive to increase its expenditure financed by foreign debt. This channel is in second order compared to the channel explained in the theoretical part of the paper since its effect is only through rent sharing of the incumbent workers with reallocated workers who constitute a relatively small portion of the total employment.

7.3 Time inconsistency: from short-run to long-run

The numerical analysis of the paper obviously faces time-inconsistency problem since I have implicitly assumed that the government commits to its announced policy on ρ. When a positive shock in public foreign assets is realized, in the periods after the announcement of its policy ρ, the government which follows preferences of N-sector workers, has incentive to choose a lower ρ to postpone saving and to provide more public expenditure compared to its

[35] Pissarides (1994) uses similar formulation to capture the impact of job seniority on the job-specific human capital.

prior announcement. Similarly, when a negative shock in the foreign assets is realized, the government has always incentive to deviate to a higher ρ to postpone its fiscal consolidation. This can give us an intuition for better understanding of long-term implications of the model. The government in more decentralized-wage countries has more political incentive to deviate from its announced policy toward less fiscal consolidation and more fiscal expansion. The search&match feature of this model restrains a time-consistent analysis of the policy. One possible extension of this theoretical framework is to abstract from serach&match labor market and assume sector-specific labor skills which perfectly prevents inter-sector labor mobility. Such framework can facilitate the analysis of time-consistent policy determination.

8 Summary and conclusion

One new contribution of this paper is to introduce a relationship between wage centralization and current account imbalances. The empirical results demonstrate a positive and significant relation between wage centralization and current account in a cross-section of industrial economies. The findings identify two different and complementary explanations for the positive impact of wage centralization on current account. The first explanation relies on the twin deficit hypothesis and argues that wage centralization tends to improve current account by improving fiscal balance. The second explanation puts forward the hypothesis that wage centralization discourages private borrowing by reducing inequality. The twin deficits hypothesis, wage centralization-inequality relation and inequality-current account link are known from the existing literature. However, the relationship between wage centralization and fiscal balance is new. To explain this new empirical finding, this paper provides a theoretical model.

The theoretical model incorporates a political economy framework in which policy maker follows preferences of N-sector workers which constitute the majority. The government can increase public goods with borrowing from the international financial markets. The public good is built from a combination of the two goods: tradeable and non-tradeable final goods. Running a budget deficit financed by foreign debt leads to the appreciation of real exchange rate: an increase in the relative price of the N-sector good. As search frictions severely constrain between-sector labor mobility, the relative wage of workers in the N-sector goes up. Therefore workers in this sector support relatively more such twin-deficits policies since they enjoy higher provision of public goods and, at the same time, an increase in their wage. The magnitude of these effects decreases with the degree of wage centralization: unions promote inter-sectoral wage equality and, consequently, the sensitivity of sector-specific wages to changes in relative prices is lowered when the wage is more centralized. Thus, the gains and

losses from twin-deficit policies are smaller. This reduces the thirsts of the N-sector workers for higher twin-deficits and their dismay for a reform in the two balances. As a result, the government observes less support for widening the two-deficits and less political cost for reforming the external balance through reducing its deficits.

One should be careful about policy implications of the results. Although the paper suggests that wage centralization improves current account, one should notice the possibility of the negative impact of the former on growth and investment. The existing literature suggests decentralization of wage bargaining as a policy which can lead to wage flexibility, higher growth and better market performance. This paper does not rule out these hypotheses. Yet, it suggests that wage setting system can have important impact on the current account. This calls for homogenizing labor market arrangements inside the currency unions.

One restriction of the empirical study in this paper is the lack of data for wage centralization. Once more data is available, the validity of the hypotheses of this paper can be reexamined by wider range of industrial countries. Theoretical framework provided by this model is also restricted by assuming no private saving. One future study can be a model which accounts for private saving with friction in international capital movement. Such a study can capture also an incomplete Ricardian effect which is absent in my model.

Appendix A: Wage centralization, wage level and current account: German Miracle

Decentralization of wage bargaining in Germany started from the mid 90's. In West Germany the proportion of employees subject to area-wide wage agreement fell from 72.2 percent in 1995 to 62.9 in 2002. In East Germany that number fell from, 56.3 percent in 1996 to 42.7 percent in 2002 (Ochel (2005)). The German current account, however, started to increase only after 2000, one year after the establishment of the Eurozone (see figure (A.1,a)). Between 1995 and 2000, when wage decentralization had been already in process, the German external balance was still in its steady deficit trend of around 1.5 percent of GDP. Moreover, the wage share continued its steady trend of after the German reunification till 2003. The decline in wage share started only after 2003: the wage share in manufacturing declined from 70 percent to 63.5 and 62 percent in 2006 and 2007 (see figure (A.1,b)) .[36] The main and distinguishing labor market reform in 2003 was not decentralization of wage bargaining. Rather, the so-called Hartz labor market reforms in 2002 can better explain this decreasing trend in wage share in Germany. The Hartz committee focused on reducing unemployment duration by strengthening incentives to actively search for a job, and on improving job placement. Hartz labor market reforms shortened the period in which unemployment benefit was paid. It reduced the benefits for long-term unemployment and tightened the conditions for unemployed households to refuse a job and finally, it abolished the early-retirement options. All these reforms led to significant increase in labor market participation, to reduction in unemployment and, more related to this paper, to decline in wage level (see Jacobi and Kluve (2007) and Krebs and Scheffel (2013) for more details on the macroeconomic impacts of the Hartz labor market reforms). Therefore, it seems that it was mostly these later reforms that are responsible for the reduction in German aggregate wages and not the decentralization of wage bargaining.

Nevertheless, wage reduction and its associated increase in competitiveness was not the only source of the observed increase in the German current account which is realized after 2000. Kollmann et al. (2015) attribute the steady rise in the German external balance to other factors such as: (i) the establishment of the Eurozone and its associated increase in financial integration in Europe which triggered capital flows from Germany to the rest of Europe. (ii) strong growth in emerging countries which boosted the demand for investment goods, given the German's specialization in those goods. (iii) the growth of outsourcing by

[36]Similar to several industrial countries wage share in manufacturing increased in 2008 and 2009 to 66 and 73 percent in 2008 and 2009 (in Germany) and declined afterward to almost steady trend around 65 percent.

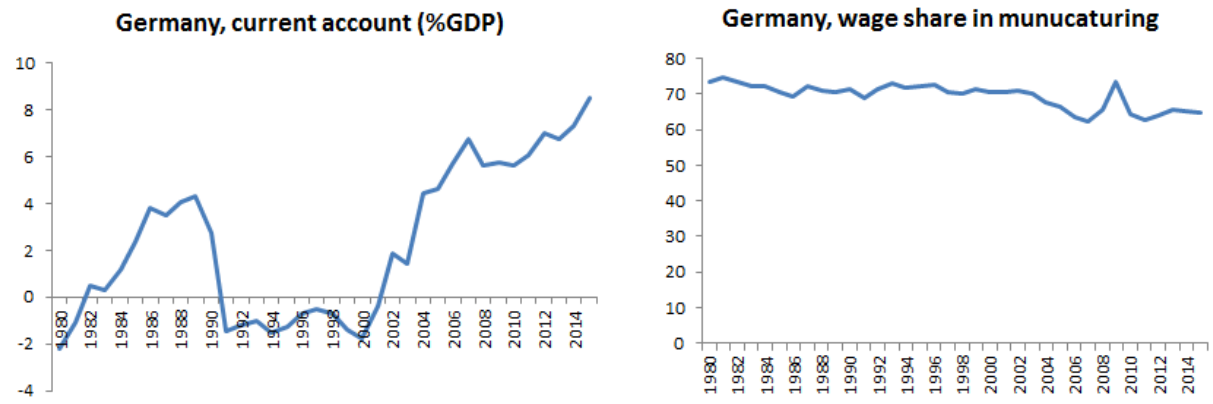


Figure A.1: **(a)** Current account (% GDP) (Data from IMF outlook, 2016) **(b)** Share of wage income in manufacturing sector (Data from AMECO).

German firms to low wage countries, notably in Eastern Europe. (iv) high saving rate in Germany that can be due to the demographic changes in that country. It is also worthwhile to mention that if the financial market is highly integrated, low wage share implies profitability of investment and inflow of foreign capital. Therefore, it is not theoretically clear if there is a negative relation between the aggregate wage level and the current account.

Appendix B: Wage centralization, inequality and current account

In this Appendix, I test a possible complementary explanation for the positive impact of wage centralization on current account. This complementary explanation relies on wage centralization-income inequality linkage and on inequality-current account hypothesis: (i) wage centralization tends to reduce inequality. (ii) Inequality tends to affect negatively the current account (Kumhof et al. (2012), Behringer et al. (2013)). In the first step, I test the first hypothesis for my sample. In the second step, I test the impact of inequality on current account when it is added to the benchmark set of the explanatory variables of current account.

Inequality and wage centralization

To be consistent with Kumhof et al. (2012), I use alternatively the top 1% and 5% income shares as a proxy for income inequality. I estimate these two proxies separately as a function of some candidate variables from the benchmark explanatory variables of current account

that are likely to have impact on income inequality. For both measures of inequalities, I test the two following specifications using 3-year averages and 5-year averages of the data:

$$Incomeinequality_{i,t} = \gamma_0 + \gamma X_{i,t} + \epsilon_{i,t}$$
$$Incomeinequality_{i,t} = \gamma_0 + \gamma_C \quad wagecentralization_{i,t} + \gamma X_{i,t} + \epsilon_{i,t}$$

The dependent variable is income inequality which is represented alternatively by top 1% and top 5% income shares. The source for the data on inequality is the same as in Kumhof et al. (2012) (The World Top Incomes Database). $X_{i,t}$ is a set of candidate explanatory variables which includes: private credit relative to GDP which is a proxy for financial development, average GDP growth (time invariant variable), net foreign assets (% GDP), old and young dependency ratios. The sample of countries are the same as in subsection 4.1 excluding Belgium for which the data for inequality does not exist in TWTID. The data are measured with no cross-sectional demeaning.

The results for these regressions are reported in tables 10 and 11 for the top 5% and 1% income shares, respectively. In each table the regressions for 3-year and 5-year averages of data are reported for the specification including and excluding the Iversson index. The results from table 10 suggest that wage centralization tends to substantially reduce top 5% income share in the panel of industrial economies. One must notice that including the Iverson index in the set of explanatory variables increases the R-squared to more than double. The impact of wage centralization on top 1% income share is rather tentative and smaller compared to the impact on top 5% income share. This can be explained by the fact that wage income, which is directly affected by wage centralization, constitutes relatively higher share of total income for households in top 5% income level than for households in top 1% income level. In other words, for the households in top 1% income level, a large share of total income is from capital income which is not directly affected by wage centralization. Since the main interest of this paper is wage centralization, I focus more on the top 5% income share.

According to the results reported in table 10, financial development, average GDP growth, initial net foreign asset (% GDP) and to a lesser extent, old dependency ratio go in the same direction with inequality, while, there is tentative evidence that relative income and young dependency ratio generally have negative impact on inequality. The positive impact of relative income on inequality is consistent with Kuznets curve.

Current account, inequality and wage centralization

To test the impact of inequality on current account, I test the following specifications for 3-years and 5-year averages of data:

$$\frac{CA_{i,t}}{GDP_{i,t}} = \alpha_0 + \alpha_I \quad IncomeInequality_{i,t} + \alpha_B \quad BudgetBalance_{i,t} + \alpha X_{i,t} + \epsilon_{i,t}$$

$$\frac{CA_{i,t}}{GDP_{i,t}} = \alpha_0 + \alpha_C \quad wageCentralization_{i,t} + \alpha X_{i,t} + \epsilon_{i,t}$$

Income Inequality is measured alternatively as top 5% and 1% income shares. $X_{i,t}$ is the same set of explanatory variables as in subsection 4.1. I test the models with demeaned data (except for the NFA, relative income and the Iverson index).[37] In table 12, I report the results of these regressions for 3-year and 5-year averages of the data. The results suggest that both the twin deficits hypothesis and inequality-current account hypothesis are significant.[38] Columns (3) and (6) also confirm the positive impact of wage centralization on current account once this variable is substituted for inequality and budget balance.[39]

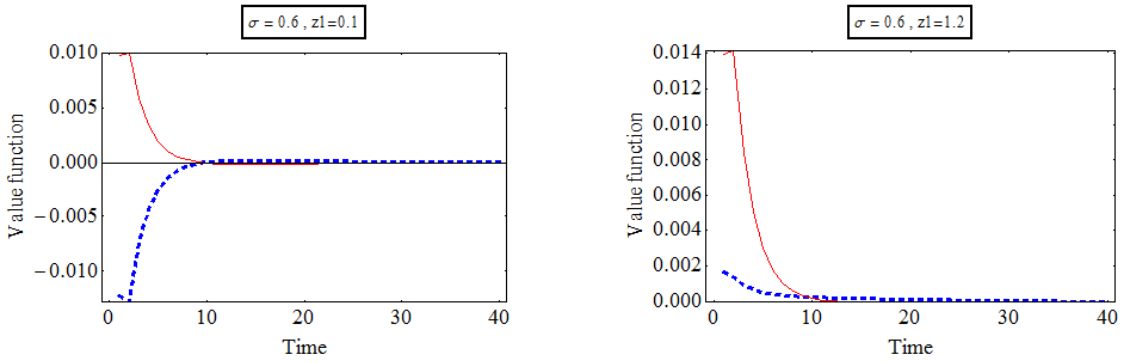
By using the same regressions with the level data, no evidence is found for inequality-current account hypothesis. Hausman test rules out the validity of random effect regression when both inequality and fiscal balance are included in the model. The same regressions with level data, by controlling for country-fixed effects, again verifies both hypotheses. The negative impact of inequality on current account and the negative impact of wage centralization on inequality suggest that wage centralization can have positive impact on current account through reducing inequality.

[37] Using cross-sectional demeaned measurement for these three variables is tested (not reported). the results are not sensitive to the choice of measurement for these variables.

[38] This result is different from that of Kumhof et al. (2012) in the sense that they found that the more important role is played by top 1% income share, while the results of this paper identify a more significant impact of the top 5% income share.

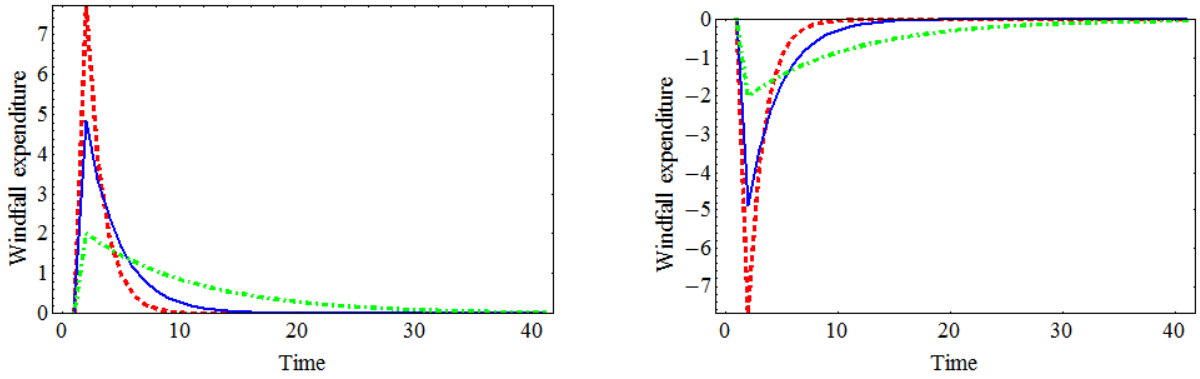
[39] Once the three variables are included in the model, Iverson index is not significant which implies the high correlation between wage centralization and the two other variables. In fact the correlation of the Iverson index with budget balance and the top 5% income share is 0.38 and -0.7.

Appendix C: Graphs



Solid line and dashed line correspond to N-sector and T-sector respectively.

Figure C.1: Effect of Windfall expenditure on the household inter-temporal utility for different marginal rate of substitution between private and public goods.



Solid line (blue): Shock in windfall income. Dashed line (red): Windfall expenditure with accelerating policy. Dot-dashed line (green): Windfall expenditure with smoothing policy.

Figure C.2: Effect of smoothing policy.

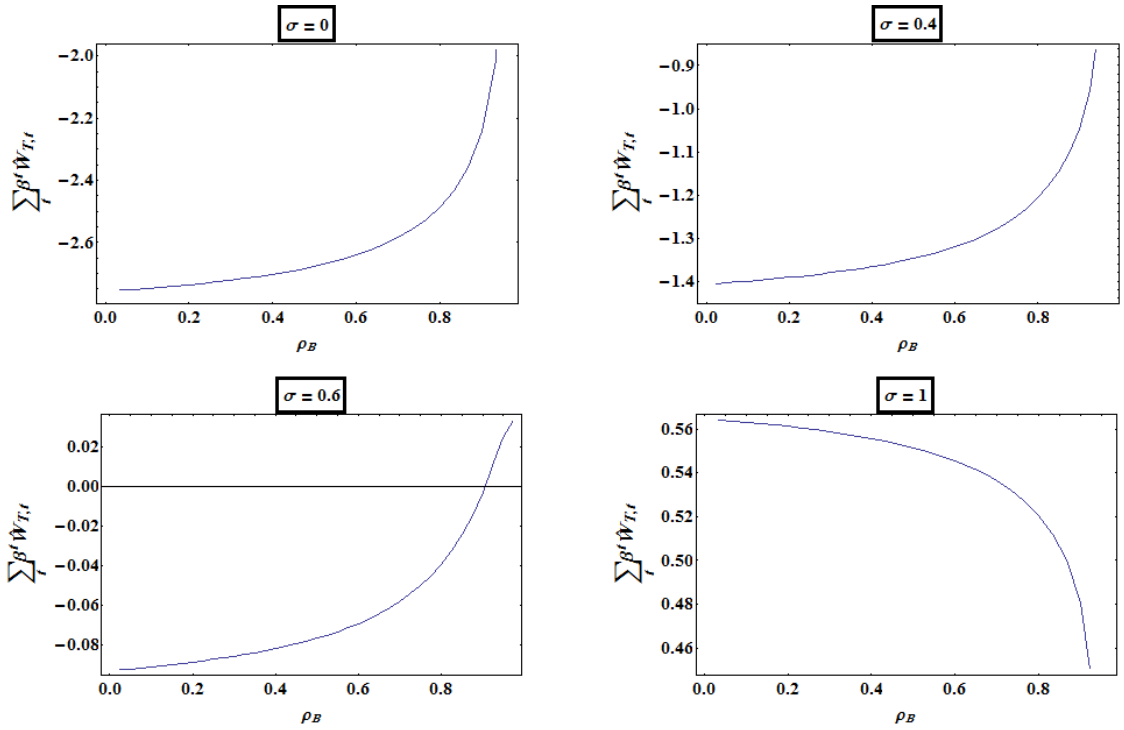


Figure C.3: Discounted value of wage changes (% of steady state value) for T-sector workers as a function of smoothing policy for different levels of wage centralization.

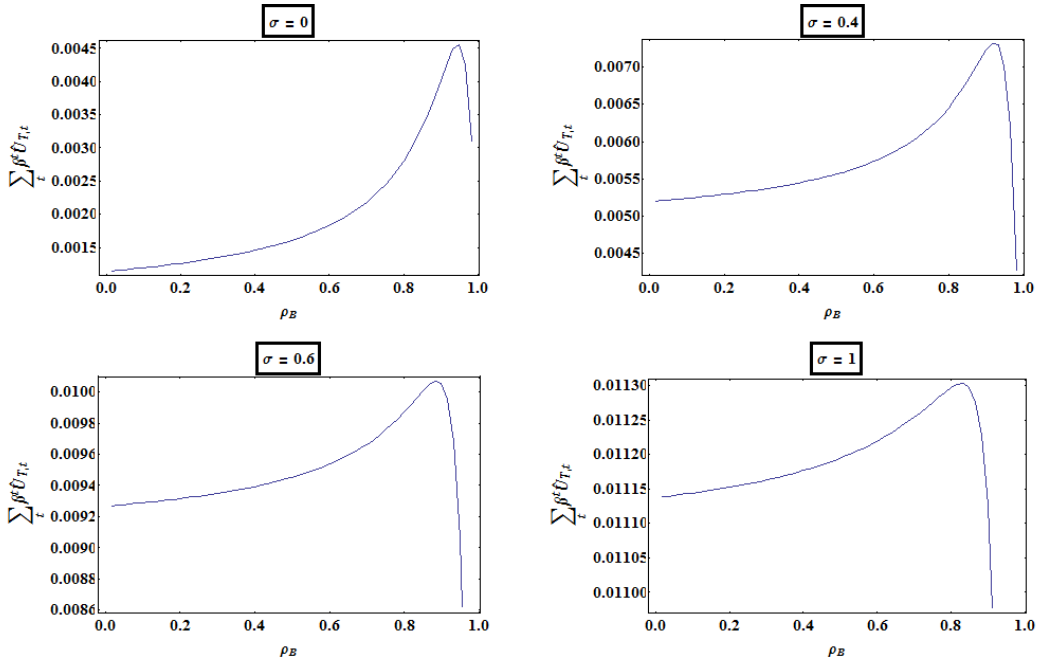


Figure C.4: Inter-temporal utility of T-sector workers as a function of policy for different levels of wage centralization.

Appendix D: Tables

Table 4: Iverson index (*)

Country	70's	80's	90's	2001-2012
US	0,12	0,12	0,14	0,18
UK	0,40	0,10	0,09	0,11
France	0,19	0,20	0,19	0,21
Japan	0,17	0,21	0,25	0,30
Canada	0,28	0,25	0,27	0,30
Spain	0,27	0,31	0,34	0,35
Italy	0,32	0,31	0,35	0,34
Switzerland	0,34	0,34	0,28	0,32
Finland	0,42	0,40	0,39	0,40
Australia	0,47	0,64	0,57	0,39
Belgium	0,47	0,45	0,45	0,46
Germany	0,46	0,41	0,42	0,48
Denmark	0,57	0,52	0,51	0,46
Sweden	0,56	0,53	0,52	0,51
Netherlands	0,48	0,54	0,54	0,57
Norway	0,61	0,56	0,55	0,51
Austria	0,95	0,97	0,97	0,91

(*) Sources for the Iverson indices: AIAS

Table 5: Rank ordering of countries according to their degree of wage centralization

Ranking	Calmfors-Driffill[a]	Schmitter[b]	Cameron[c]	Blyth[d]	Bruno-Sachs[e]
1	Austria	Austria	Sweden	Austria	Austria
2	Norway	Norway	Norway	Norway	Germany
3	Sweden	Sweden	Austria	Sweden	Netherlands
4	Denmark	Denmark	Belgium	Denmark	Norway
5	Finland	Finland	Finland	Finland	Sweden
6	Germany	Netherlands	Denmark	New Zealand	Switzerland
7	Netherlands	Belgium	Netherlands	Australia	Denmark
8	Belgium	Germany	Germany	Germany	Finland
9	New Zealand	Switzerland	UK	Belgium	Belgium
10	Australia	US	Australia	Netherlands	Japan
11	France	Canada	Switzerland	Japan	New Zealand
12	UK	France	Italy	France	UK
13	Italy	UK	Canada	UK	France
14	Japan	Italy	US	Italy	Italy
15	Switzerland		France	US	Australia
16	US		Japan	Canada	Canada
17	Canada				US

[a] Source: Calmfors and Driffill (1988). [b] Source: Schmitter (1981). [c] Source: Cameron (1984). [d] Source: Blyth (1979). [e]Source: Bruno and Sachs (1985).

Table 6: Variable Definitions & Sources for Panel Estimation

CA (% of GDP)	Current account balance, ratio to GDP	IMF World Economic Outlook (2016)
BB (% of GDP)	Government budget balance, ratio to GDP	IMF World Economic Outlook (2016)
Iverson index	Index for wage centralization	Amsterdam Institute for Advanced Labor Studies (AIAS)
Private credit (% of GDP)	Ratio of private credit to GDP	World Bank Financial structure database (2011)
GDP growth	measured alternatively by average real GDP-per-capit growth and by changes in GDP-per-capita growth	World Bank World Bank
NFA (% of GDP)	Stock of Net Foreign Assets, ratio to GDP	Lane & Milesi-Ferretti
Relative income	Per capita income, measured relative to the U.S.	IMF World Economic Outlook (2016)
GDP deviation	Deviation of GDP from trend, ratio to GDP ternd	Using the GDP derived from IMF World Economic Outlook (2016)
Population growth	Annual population rowth	World bank
Trade openness	Openness indicator: ratio of exports plus imports of goods to GDP	OECD databasee
Old dependency ratio	Youth dependency ratio, population under 15 relative to the population between 15 and 65	World Development Indicators (2010)
Young dependency ratio	Old dependency ratio, population over 65 relative to the population between 15 and 65	World Development Indicators (2010)
Top 1% and 5% income share	Share of income of the top 1% and 5% of the income distribution	The World Top Incomes Database

Panel consists of Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, Switzerland, UK & the United States.

Table 7: Summary of selected studies of current account balance determinants

	Arabzadeh (Level) (2016)	Arabzadeh (GDP-av deviated) (2016)	Decressin &Starvev (2009)	Cheung C. et al (2013)	Barnes et al (2010)	Chinn &Prasad (2003)	Chinn et al. (2014)
Govt. budget balance	+	+	+	x	+	x	+
Private credit ratio	x	-	x	()	x	x	x
Average GDP growth	x	x	-	x	x	()	x
Net foreign asset	+	+	+	+	+	+	+
Relative income	+	+	+	+	+	+	x
Population growth	-	-	-	()	()	()	()
Trade openness	+	x	x	+	+	x	x
Old depend. ratio	x	-	-	x	x	x	x
Young depend. ratio	x	+	-	x	+	x	x
Countries	16 OECD	16 OECD	11 Euro	30 OECD	25 OECD	18 indus.	23 indus.
Sample	1982-11	1980-12	1970-07	1973-08	1969-08	1971-95	1970-08

+ : Positive effect, significant at least at 10%.
- : Negative effect, significant at least at 10%.
x : Not significant at 10%.
() : Not included in the model.

Table 8: Panel Regression, OLS Specification, Level Data

Current account	5-year averages			3-year averages		
	(1)	(2)	(3)	(4)	(5)	(6)
Govt. budget balance	0.267***		0.201**	0.284***		0.252***
	(0.080)		(0.084)	(0.061)		(0.066)
Iverson index		7.889***	6.864**		5.252**	3.503
		(2.889)	(3.039)		(2.672)	(2.627)
Private credit ratio	0.012	0.020**	0.017**	0.013**	0.019***	0.016**
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)
Δ GDP growth	0.177	0.570	-0.054	0.539	1.518	0.491
	(1.125)	(1.185)	(1.142)	(0.946)	(1.091)	(1.049)
Net foreign asset	0.044***	0.056***	0.053***	0.045***	0.055***	0.049***
	(0.010)	(0.011)	(0.011)	(0.008)	(0.009)	(0.009)
Relative income	3.280**	2.852*	2.296	2.394*	2.053	1.746
	(1.594)	(1.678)	(1.633)	(1.267)	(1.431)	(1.376)
Population growth	-3.224***	-2.920***	-2.836***	-3.431***	-3.107***	-3.333***
	(1.032)	(1.067)	(1.035)	(0.777)	(0.834)	(0.801)
Trade openness	0.025**	0.009	0.010	0.019**	0.013	0.014
	(0.011)	(0.013)	(0.013)	(0.009)	(0.011)	(0.010)
Old dependency ratio	0.038	0.091	0.055	-0.022	0.033	0.004
	(0.105)	(0.108)	(0.104)	(0.083)	(0.096)	(0.092)
Young dependency ratio	0.107	0.183	0.172	0.016	0.018	0.042
	(0.123)	(0.128)	(0.125)	(0.095)	(0.100)	(0.099)
Constant	-6.203	-13.313**	-9.283	-1.971	-7.982	-3.887
	(5.670)	(5.742)	(5.776)	(4.531)	(5.071)	(4.989)
Rsquared	0.65	0.64	0.67	0.61	0.56	0.62
Observations	89	91	89	156	158	153

Standard errors are reported in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Table 9: Panel Regression for Annual Data, OLS Specification

	Including Australia		Excluding Australia	
	(1)	(2)	(3)	(4)
Budget balance	0.218***		0.233***	
	(0.038)		(0.039)	
Iverson index		2.721		5.389**
		(2.358)		(2.410)
Private credit ratio	0.013***	0.018***	0.013***	0.018***
	(0.005)	(0.005)	(0.005)	(0.005)
Δ GDP growth	0.498	1.782*	1.285	2.673***
	(0.820)	(0.979)	(1.004)	(0.986)
Relative income	0.810	0.176	0.674	0.324
	(0.839)	(0.914)	(0.879)	(0.911)
Net foreign asset	0.047***	0.057***	0.046***	0.057***
	(0.006)	(0.006)	(0.006)	(0.006)
Population growth	-2.878***	-2.622***	-3.111***	-2.464***
	(0.499)	(0.546)	(0.526)	(0.561)
Old dependency ratio	0.034	0.070	0.025	0.059
	(0.060)	(0.069)	(0.061)	(0.068)
Young dependency ratio	-0.004	-0.041	-0.021	-0.031
	(0.065)	(0.067)	(0.066)	(0.067)
Constant	-0.787	-4.729	-1.423	-7.606**
	(3.372)	(3.802)	(3.536)	(3.740)
Rsquared	0.53	0.46	0.50	0.47
Observations	443	434	419	422

Standard errors are reported in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 10: Panel Regression for 5% income share

5% income share	5-year averages		3-year averages	
Columns	(1)	(2)	(3)	(4)
Iverson index		-10.734***		-10.090***
		(3.382)		(2.857)
Private credit ratio	0.028***	0.026***	0.026***	0.023***
	(0.007)	(0.007)	(0.005)	(0.005)
Average GDP growth	3.268	3.623**	2.966	3.317**
	(2.095)	(1.465)	(2.025)	(1.308)
Relative income	-2.853*	-3.257**	-2.150*	-2.539**
	(1.611)	(1.577)	(1.145)	(1.170)
Net foreign asset	0.027**	0.024**	0.021***	0.021***
	(0.011)	(0.011)	(0.008)	(0.008)
Old dependency ratio	0.172*	0.181*	0.184**	0.226***
	(0.100)	(0.100)	(0.073)	(0.083)
Young dependency ratio	-0.160	-0.208*	-0.125*	-0.139*
	(0.114)	(0.113)	(0.075)	(0.077)
Constant	14.370**	19.237***	13.401**	16.403***
	(6.911)	(5.972)	(5.731)	(4.778)
Rsquared	0.30	0.61	0.29	0.62
Observations	86	86	149	145

Standard errors are reported in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 11: Panel Regression for 1% income share

1% income share	5-year averages		3-year averages	
Columns	(1)	(2)	(3)	(4)
Iverson index		-3.993		-3.939*
		(2.744)		(2.357)
Private credit ratio	0.019***	0.017***	0.019***	0.016***
	(0.005)	(0.005)	(0.004)	(0.004)
Average GDP growth	2.106	2.252	1.732	1.848
	(1.506)	(1.383)	(1.418)	(1.267)
Relative income	-1.181	-1.131	-1.006	-0.937
	(1.190)	(1.184)	(0.861)	(0.888)
Net foreign asset	0.017**	0.016**	0.011*	0.011*
	(0.008)	(0.008)	(0.006)	(0.006)
Old dependency ratio	0.060	0.072	0.067	0.099
	(0.074)	(0.075)	(0.055)	(0.063)
Young dependency ratio	-0.143*	-0.153*	-0.110*	-0.103*
	(0.084)	(0.084)	(0.057)	(0.058)
Constant	5.341	6.606	4.919	5.380
	(5.041)	(4.895)	(4.127)	(4.050)
Rsquared	0.22	0.32	0.22	0.32
Observations	86	86	149	145

Standard errors are reported in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 12: Panel Regression with Inequality, Mean-Deviated Data

Current account	5-year averages			3-year averages		
	(1)	(2)	(3)	(4)	(5)	(6)
Top 5% income share	-0.377***			-0.312***		
	(0.104)			(0.090)		
Top 1% income share		-0.357**			-0.329**	
		(0.152)			(0.139)	
Iverson index			7.629***			6.079***
			(2.747)			(1.987)
Govt. budget balance	0.178**	0.232***		0.209***	0.254***	
	(0.085)	(0.087)		(0.079)	(0.079)	
Private credit ratio	-0.013	-0.019**	-0.017*	-0.022***	-0.027***	-0.015**
	(0.009)	(0.009)	(0.009)	(0.008)	(0.008)	(0.007)
Δ GDP growth	0.828	0.935	0.553	0.237	0.293	0.056
	(0.618)	(0.652)	(0.674)	(0.243)	(0.247)	(0.267)
Net foreign asset	0.071***	0.065***	0.066***	0.064***	0.061***	0.061***
	(0.010)	(0.010)	(0.010)	(0.008)	(0.008)	(0.008)
Relative income	1.883	3.635**	4.696***	2.137	3.022**	4.435***
	(1.652)	(1.602)	(1.603)	(1.323)	(1.311)	(1.230)
Population growth	-3.792***	-3.665***	-3.657***	-3.683***	-3.661***	-3.799***
	(0.930)	(0.974)	(0.976)	(0.750)	(0.769)	(0.731)
Trade openness	-0.004	0.004	-0.006	-0.011	-0.007	0.001
	(0.012)	(0.012)	(0.013)	(0.010)	(0.010)	(0.009)
Old dep. ratio	-0.298**	-0.303**	-0.232*	-0.295***	-0.320***	-0.257***
	(0.117)	(0.123)	(0.124)	(0.101)	(0.105)	(0.097)
Young dep. ratio	0.171	0.124	0.185	0.154	0.124	0.147*
	(0.110)	(0.114)	(0.115)	(0.094)	(0.096)	(0.086)
Constant	-2.196	-3.679**	-5.989***	-2.305*	-3.069**	-5.333***
	(1.517)	(1.516)	(1.529)	(1.263)	(1.288)	(1.131)
Rsquared	0.71	0.69	0.66	0.65	0.63	0.60
Observations	83	83	85	141	141	147

Standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 13: Panel Regression with Inequality Effect, Level data

Current account	5-year averages			3-year averages		
	(1)	(2)	(3)	(4)	(5)	(6)
Top 5% income share	-0.015			0.035		
	(0.107)			(0.084)		
Top 1% income share		0.207			0.278**	
		(0.160)			(0.124)	
Iverson index			7.789***			5.693**
			(2.527)			(2.235)
Govt. budget balance	0.299***	0.298***		0.296***	0.295***	
	(0.092)	(0.090)		(0.066)	(0.063)	
Private credit ratio	0.014	0.015*	0.016**	0.012*	0.013**	0.015**
	(0.009)	(0.009)	(0.008)	(0.007)	(0.006)	(0.007)
Δ GDP growth	0.053	-0.273	0.406	0.328	0.148	1.306
	(1.248)	(1.230)	(1.005)	(0.930)	(0.864)	(0.890)
Net foreign asset	0.046***	0.041***	0.054***	0.047***	0.041***	0.055***
	(0.012)	(0.011)	(0.010)	(0.009)	(0.008)	(0.008)
Relative income	2.686	2.930*	3.362**	2.597*	2.851**	2.772**
	(1.813)	(1.730)	(1.565)	(1.342)	(1.236)	(1.321)
Population growth	-2.913**	-3.191***	-2.803***	-3.045***	-3.473***	-2.934***
	(1.151)	(1.164)	(1.054)	(0.833)	(0.827)	(0.832)
Trade openness	0.026*	0.032**	0.017	0.024**	0.032***	0.018
	(0.015)	(0.015)	(0.014)	(0.011)	(0.011)	(0.011)
Dependency ratio	0.066	0.067	0.083	0.011	-0.000	0.056
(old)	(0.114)	(0.114)	(0.104)	(0.088)	(0.084)	(0.091)
Dependency ratio	0.109	0.169	0.175	0.044	0.092	0.050
(young)	(0.135)	(0.137)	(0.121)	(0.097)	(0.095)	(0.095)
Constant	-6.066	-9.623	-13.073**	-4.235	-6.983	-9.684**
	(6.706)	(6.525)	(5.244)	(4.909)	(4.629)	(4.567)
Rsquared	0.65	0.64	0.65	0.62	0.64	0.59
Observations	80	80	85	141	141	147

Standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 14: Estimation for Households Private Saving, Cross-sectional deamining

Household Saving	3-year averages				5-year averages			
	No fixed-effect		with fixed-effect		No fixed-effect	with fixed-effect		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Govt. budget balance	-0.398***		-0.286***		-0.342***		-0.277**	
	(0.100)		(0.095)		(0.126)		(0.118)	
Top 5% income share	-0.398***		-0.504***		-0.539***		-0.796***	
	(0.133)		(0.144)		(0.194)		(0.225)	
Iverson index		-6.657		-4.517		-6.034		-6.454
		(4.444)		(5.786)	(5.769)			(7.785)
Private credit ratio	-0.042***	-0.040***	-0.050***	-0.047***	-0.036***	-0.037**	-0.048***	-0.044***
	(0.010)	(0.010)	(0.009)	(0.010)	(0.014)	(0.015)	(0.014)	(0.015)
Net foreign asset	0.069***	0.058***	0.055***	0.048***	0.077***	0.060***	0.065***	0.050**
	(0.012)	(0.012)	(0.013)	(0.013)	(0.018)	(0.018)	(0.020)	(0.021)
Relative income	1.873	0.465	2.863*	1.594	1.546	2.167	2.250	3.456
	(1.742)	(1.839)	(1.666)	(1.814)	(2.630)	(2.676)	(2.575)	(2.755)
Δ GDP growth	-0.089	0.259	-0.003	0.274	0.881	1.178	1.301*	1.506*
	(0.290)	(0.285)	(0.258)	(0.262)	(0.840)	(0.906)	(0.755)	(0.849)
Old dependency ratio	-1.012***	-0.958***	-0.969***	-0.924***	-0.989***	-0.909***	-1.016***	-0.850***
	(0.134)	(0.156)	(0.130)	(0.158)	(0.193)	(0.209)	(0.192)	(0.217)
Young dependency ratio	0.083	0.179	0.405**	0.533***	-0.028	0.018	0.301	0.529*
	(0.168)	(0.176)	(0.180)	(0.188)	(0.231)	(0.246)	(0.255)	(0.277)
Population growth	0.169	-1.116	0.278	-0.582	1.730	0.773	2.584	2.485
	(1.043)	(1.081)	(1.017)	(1.061)	(1.570)	(1.662)	(1.571)	(1.699)
Constant	-2.801	1.664	-4.670***	-0.206	-3.283	-0.278	-5.213**	-1.202
	(1.799)	(2.424)	(1.596)	(2.715)	(2.623)	(3.255)	(2.436)	(3.793)
Observations	137	141	137	141	81	83	81	83
Overall R-squared	0.54	0.19	0.11	0.07	0.25	0.18	0.09	0.05
Within R-squared	0.29	0.49	0.57	0.51	0.58	0.48	0.62	0.52

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

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