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Fiscal austerity, unemployment and family firms

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Non-technical summary

Research Question

In this paper, I calculate unemployment multipliers of expenditure and revenue-side fiscal consolidation policies in the presence of sectoral heterogeneity, ie. in the presence of family and non-family firms.

Many countries have experienced a rise in government debt since the recent crisis, which increases the need for fiscal consolidation, while, unemployment has simultaneously reaching historically high levels. Fiscal consolidation also affects unemployment. Our knowledge of unemployment fiscal multipliers is not complete, however. Concerning expenditure-side unemployment multipliers, evidence about both the sign and the magnitude is mixed. Moreover, there are not yet any revenue-based unemployment fiscal multipliers.

I develop a model, based on a standard New Keynesian framework with search and matching frictions, as an innovation, with sectoral heterogeneity, ie. family and non-family firms. The motivation for this is that family-owned firms employ a significant share of the labor force, and these firms behave differently in the labor market. For the purpose of illustration, the model is calibrated to match data of those European countries where family firms are present more than average in the labor market.

Contribution

Regarding the existing literature, my results are consistent with the suggestion that a tightening of fiscal policy on the expenditure side increases unemployment. Moreover, consistent with *Ball et al. (*2013*)*, a cut in government consumption implies a more pronounced effect on unemployment than tax-based adjustments (only at peak though). But the relevant authors consider a narrative approach, which means they are unable to compare tax policies, while my paper is the first to provide estimates of unemployment multipliers of different tax policies. Furthermore, sectoral heterogeneity on the firm side might explain the gap between theoretical and empirical multipliers reported, but unexplained by *Monacelli et al. (*2010*)*.

Results

My model predicts that fiscal austerity raises unemployment. At peak, the largest increase in unemployment is implied by a cut in government consumption. Nevertheless, a hike in employees' labor income tax, cumulatively, implies the same size of increase in unemployment as the government consumption cut does. A higher employer social security contribution is, however, less costly in terms of employment than an increase of the same scale in employees' labor income tax hike. Both at peak and cumulatively, unemployment reacts least when the budget is consolidated by increasing the rate of value added tax. However, there are trade-offs a policy-maker must face, as the increase in value added tax results in the largest decline in consumption.

Sectoral heterogeneity seems to play a crucial role, unemployment multipliers are very different with and without it. Multipliers of labor income tax policies and government consumption multipliers are usually biased downwards, while the consumption tax multipliers are often biased upwards, when homogeneous firms are considered. Thus, ignoring sectoral heterogeneity might lead to incorrect policy conclusions, although, according to my results, budget consolidation is always least harmful for employment when it is implemented by increasing consumption tax revenue.

Nichttechnische Zusammenfassung

Forschungsfrage

In der vorliegenden Arbeit werden Multiplikatoren der Arbeitslosigkeit bei ausgaben- und einnahmenseitigen fiskalischen Sparmaßnahmen berechnet. Dabei wird eine sektorale Heterogenität, d. h. das Vorhandensein familien- und nicht-familiengeführter Unternehmen, zugrunde gelegt.

Seit der jüngsten Krise ist es in zahlreichen Ländern zu einem Anstieg der Staatsverschuldung gekommen, wodurch sich die Notwendigkeit einer Haushaltskonsolidierung erhöht, während zugleich die Arbeitslosigkeit auf ein im historischen Vergleich hohes Niveau geschnellt ist. Haushaltskonsolidierungen schlagen sich auch auf die Arbeitslosenquote nieder. Allerdings sind die Erkenntnisse über die fiskalischen Multiplikatoren der Arbeitslosigkeit noch unvollständig. Weder zum Vorzeichen noch zum Umfang der ausgabenseitigen Multiplikatoren der Arbeitslosigkeit gibt es einheitliche Belege. Darüber hinaus liegen bislang keine einkommensbasierten fiskalischen Arbeitslosigkeitsmultiplikatoren vor.

In dieser Arbeit wird ein neues Modell entwickelt. Es basiert auf einem neukeynesianischen Standardmodell mit Such- und Anpassungsfriktionen und berücksichtigt als neues Element eine sektorale Heterogenität, indem es zwischen familien- und nicht-familiengefhrten Unternehmen unterscheidet. Dem liegt die Überlegung zugrunde, dass ein beträchtlicher Teil der Erwerbspersonen bei Familienunternehmen beschäftigt ist und sich diese Unternehmen am Arbeitsmarkt anders verhalten. Zur Veranschaulichung ist das Modell an die Daten jener Euro-Länder kalibriert, in denen Familienunternehmen überdurchschnittlich hoch am Arbeitsmarkt präsent sind.

Forschungsbeitrag

Die Ergebnisse der Untersuchung entsprechen der in der Fachliteratur vorgebrachten Annahme, dass eine fiskalische Straffung auf der Ausgabenseite die Arbeitslosigkeit erhöht. Im Einklang mit den Resultaten von *Ball et al. (*2013*)* wirken sich Kürzungen der staatlichen Konsumausgaben stärker auf die Arbeitslosigkeit aus als steuerbasierte Anpassungen (allerdings nur in der Spitzenwertbetrachtung). Ball et al. verwenden allerdings einen narrativen Ansatz, der keinen Vergleich der steuerpolitischen Maßnahmen zulässt; die vorliegende Arbeit liefert erstmals Schätzungen der Arbeitslosigkeitsmultiplikatoren bei verschiedenen Steuermaßnahmen. Darüber hinaus knnte sektorale Heterogenität auf der Unternehmensseite ein Grund für den Abstand zwischen den theoretisch und empirisch ermittelten Multiplikatoren sein, den *Monacelli et al. (*2010*)* zwar beobachtet haben, aber nicht erklären konnten.

Forschungsergebnisse

Das in dieser Arbeit entwickelte Modell legt den Schluss nahe, dass Haushaltssparmaßnahmen die Arbeitslosigkeit erhöhen. In der Spitzenwertbetrachtung ergibt sich der stärkste Anstieg der Arbeitslosigkeit bei Kürzungen der Konsumausgaben des Staates. In der kumulierten Betrachtung führen Lohnsteuererhöhungen allerdings

zu einem ebenso hohen Anstieg der Arbeitslosigkeit wie Kürzungen der öffentlichen Konsumausgaben. Anhebungen der Sozialbeiträge der Arbeitgeber fordern jedoch einen weniger hohen Tribut in Bezug auf die Beschäftigung vergleichbare Lohnsteuererhöhungen. Sowohl in der Spitzenwertbetrachtung als auch kumuliert gerechnet reagiert die Arbeitslosenquote am schwächsten, wenn die Haushaltskonsolidierung über eine Mehrwertsteueranhebung erfolgt. Für die politisch Verantwortlichen ergeben sich allerdings Zielkonflikte, da Mehrwertsteuererhöhungen den stärksten Konsumrückgang bewirken.

Der sektoralen Heterogenität scheint eine Schlüsselrolle zuzukommen; die Multiplikatoren der Arbeitslosigkeit entwickeln sich mit und ohne Berücksichtigung dieser Heterogenität sehr unterschiedlich. Die Lohnsteuer- und Staatsausgabenmultiplikatoren sind üblicherweise abwärtsgerichtet, wohingegen die Verbrauchsteuermultiplikatoren häufig nach oben verzerrt sind, wenn homogene Unternehmen betrachtet werden. Ein Außerachtlassen der sektoralen Heterogenität knnte daher zu falschen politischen Schlussfolgerungen führen. Allerdings kommt der Beitrag zu dem Ergebnis, dass Haushaltskonsolidierungen über Konsumsteuererhöhungen im Hinblick auf die Arbeitslosigkeit immer am wenigsten schädlich sind.

Bundesbank Discussion Paper No 06/2015

Fiscal Austerity, Unemployment and Family Firms[1]

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April 15, 2015

Abstract

I calculate unemployment multipliers of fiscal consolidation policies in a standard, closed-economy New Keynesian framework with search and matching frictions, and, as an innovation, in the presence of sectoral heterogeneity. Family and non-family firms behave differently in the labor market and are differently managed. This latter assumption is modeled by the inclusion of intangible capital in the family sector. The model is calibrated to match European data on countries with a large percentage of family firms in the labor force. I find that fiscal austerity raises unemployment. Both at peak and cumulatively, unemployment reacts least when the budget is consolidated by increasing the rate of value-added tax. At peak, the highest increase in unemployment is induced by a cut in government consumption, but, cumulatively, a hike in employees' labor income tax is just as costly in terms of employment. There are trade-offs, however, which a policymaker must face, as the value-added tax increase results in the steepest decline in consumption. Sectoral heterogeneity is crucial; multipliers of labor income tax policies and government consumption multipliers are usually biased downwards, while the consumption-tax multipliers are often biased upwards. Thus, ignoring sectoral heterogeneity might lead to incorrect policy conclusions.

Keywords: fiscal austerity, government consumption, labor income tax, consumption tax, social security contribution, unemployment multiplier, sectoral heterogeneity, family firms, intangible capital

JEL codes: E22, E24, E62, J64

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[1] A technical appendix containing all the steady state and loglinearized equations is available on my website: https://sites.google.com/site/munkacsizsu/research.

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1 Introduction

Since the onset of the recent crisis, many countries have experienced a rise in government debt, thus making urgent fiscal consolidation. At the same time, unemployment in many countries has risen to historic heights. We know that fiscal consolidation further affects unemployment, but we do not know the precise mechanism behind this phenomenon. This is the question which I address in this paper. In particular, I calculate unemployment fiscal multipliers that show the effects of temporary fiscal austerity policies on the unemployment rate. My paper contributes to the literature in two ways (Subsection 1.1). First, there is a debate on the sign and the magnitude of expenditure-side unemployment fiscal multipliers. Second, as yet there are no revenue-side unemployment fiscal multipliers. The intent is to fill both of these gaps of the literature.

The multipliers are based on a standard closed-economy New-Keynesian model with search and matching frictions, and as a innovation, with family and non-family firms on the firm side. The motivation behind this sectoral heterogeneity is that firms are not homogeneous, as the standard macroeconomic models often assume. Empirical firm-level evidence from the corporate finance literature indicates that family firms behave differently in the labor market than non-family firms do (Subsection 1.2).

1.1 Unemployment fiscal multiplier literature

Unemployment fiscal multipliers show changes in the unemployment rate after a temporary fiscal policy shock. The literature focuses on the expenditure side of the budget. *Monacelli et al. (*2010*)* find that an increase of 1 percent of GDP government consumption decreases unemployment by 0.6 percentage points at peak[3], but their theoretical multiplier is much lower, around 0.2 percentage points. Similarly, *Edelberg et al. (*1999*)*, *Fatas-Mihov (*2001*)*, *Gali et al. (*2007*)*, *Forni-Gambetti (*2010*)* and *Mayer et al. (*2010*)* claim that loosening fiscal policy implies an increase in hours or employment.[4]

In contrast, *Bruckner-Pappa (*2012*)* suggest that an increase in government consumption raises unemployment.[5] Their model, which includes price rigidity, labor force participation, as well as short- and long-term unemployment reproduces their empirical findings. *Gomes (*2009*)* claims that a shock to government consumption - without the inclusion of government employment in the model[6] - implies a close-to-zero effect on unemployment. Moreover, *Dallari (*2014*)* finds that the impact multipliers of a cut in government consumption might be positive or negative.[7]

[3]Based on a VAR of the US.

[4]*Edelberg et al. (*1999*)*, *Fatas-Mihov (*2001*)* and *Gali et al. (*2007*)* consider 1-leisure as equal to hours or employment in their framework, without, however, explicitly modeling unemployment, while *Forni-Gambetti (*2010*)* provide empirical evidence based on a structural, large dimensional, dynamic factor model.

[5]A 10 percent increase in government consumption results in an increase of 0.2-0.5 percentage points in unemployment at peak by estimating structural VARs of several OECD countries.

[6]A DSGE model with search and matching frictions, public employment and wages.

[7]Multipliers vary from -4.5 to 8.7, using a panel structural VAR of European countries.

Thus, there is a debate on both the magnitude and the sign of the unemployment multiplier of government consumption.

Most papers concentrate solely on government consumption, although different government expenditure items might imply different employment effects.[8] *Bermperoglou et al. (*2013*)* find that a decrease of 1 percent of GDP in government consumption, government investment and public vacancies increase unemployment by 0.8, 0.8 and 1.8 percentage points respectively, while a decrease of 1 percent of GDP in public wages reduces unemployment by 0.1 percentage points.[9] A New Keynesian model with labor force participation, short- and long-term unemployment and public employment provides similar theoretical responses. At the same time, *Gomes (*2009*)* shows that an increase in public vacancies results in higher unemployment, while an increase in public wages declines unemployment. Moreover, *Pappa (*2009*)* finds that a positive shock to public employment decreases total employment in several US federal states.[10] Also, *Dallari (*2014*)* demonstrates that after cuts in government investment, unemployment multipliers of different countries have different signs and magnitudes.[11]

The aforementioned studies rely on aggregate government expenditure data. At the same time, the narrative approach achieves identification using historical records of the policy decision-making process. Both *Guajardo et al. (*2011*)* and *Ball et al. (*2013*)* suggest that fiscal tightening increases unemployment.[12] *Hernandez de Cos-Moral-Benito (*2011*)* report similar results.[13]

While there is no consensus in the literature regarding the sign or the magnitude of expenditure-side unemployment fiscal multipliers, I am not aware of any unemployment multipliers of tax policies.[14] Although *Ball et al. (*2013*)* claim

[8]Some papers specifically focus on military spending, which is not discussed here, see e.g. *Rotemberg-Woodford (*1992*)*, *Ramey-Shapiro (*1998*)*, *Burnside et al. (*2004*)* and *Ramey (*2009*)*.

[9]Based on a SVAR with sign restrictions of the US.

[10]Using a structural VAR with sign restrictions on US aggregate and state level data.

[11]On impact -1.7-4.1 in Europe.

[12]Both papers use a sample of OECD countries. *Guajardo et al. (*2011*)* claim that, two years after the shock, a fiscal consolidation of 1 percent of GDP implies a 0.3 percentage point increase in unemployment, while *Ball et al. (*2013*)* find that fiscal consolidation implies an increase in long-term unemployment of about 0.5 percentage points in the medium-term.

[13]Based on a panel of OECD countries.

[14]Other streams of literature study the effects of tax policies and tax shifts on employment. While a consensus has not been reached, it is unusual for the expenditure side of the budget to be compared to the revenue side of the budget. A detailed review is beyond the scope of my paper, but I would like to note the following: i) Concerning the effects of labor taxation on (cost of) employment, usually based on aggregate data and econometric methodologies, some researchers find an effect (*Alesina-Perotti,* 1997, *Blanchard-Wolfers,* 2000), while others do not (*Bean,* 1994); furthermore, others report mixed results (*Daveri et al. (*2000*)* claim that there is a significant effect in Continental Europe only). ii) While a significant share of public finance literature highlights the equivalence between consumption and labor income taxes (described e.g. in *Auerbach (*2006*)*), others claim the opposite (*Blumkin et al.,* 2012, *Sumpson,* 1986). iii) Regarding tax shifts, in particular, microsimulations also show an ambiguous picture, *Thomas-Picos-Sanchez (*2012*)* claim that a shift from social security contribution to consumption taxes only slightly increases hours, which is not in line with *Pestel-Sommer (*2013*)*. iv) As regards other effects (growth, efficiency, inequality, reform implementation), see among others *Auerbach (*2006*)* or *Pestel-Sommer (*2013*)*.

that spending-based adjustments have a more pronounced effect than tax-based adjustments, because these authors adopt a narrative approach they are not able to compare separate tax policies. *Staehler-Thomas (*2012*)* study the unemployment response of, likewise revenue-based, fiscal policies, but they consider permanent shocks with a focus on long-run effects.[15] Moreover, *Canova-Pappa (*2007*)*[16] and *Caldara-Kamps (*2008*)*[17] study a single tax shock only, without distinguishing between different tax policies.

1.2 Data and literature on family firms

Many macroeconomic models, all of them in the unemployment fiscal multiplier literature, assume a representative homogeneous firm. In my paper, I make a distinction between family and non-family firms, as, according to the available firm-level evidence documented in the corporate finance literature, these two types of firms behave very differently in the labor market. This divergent labor market behavior might be interesting from the point of view of the effects of fiscal policy on unemployment.

A family firm is a firm that is owned and/or managed by a family. As *Anderson-Reeb (*2003*)* specify, a family firm is a firm where the fraction of equity owned by a (founding) family is above a threshold, or one in which family members sit on the board of directors.

The share of family firms in the European labor force is remarkable, as Table 1[18] shows. Almost every second worker in Europe is employed by a family firm. Family firms are more prevalent in some countries than in others, employing 54.6 and 35.2 percent of the labor force, respectively.[19]

Percentage of family firms in workforce (%)			
Countries above average		Countries below average	
Austria	72.50	Finland	45.50
Estonia	50.00	Netherlands	34.78
France	49.00	Norway	40.00
Germany	50.50	Romania	19.00
Hungary	55.00	Slovenia	26.00
Ireland	50.00	Sweden	38.57
Italy	52.00	UK	37.97
Spain	72.50		
Average 56.44		Average 33.87	
Average 46.22			

Table 1: Percentage of family firms in the European labor force

[15] In a two-country DSGE model with monetary union and with government investment, employment and wages.

[16] Based on a dataset of US states and EU countries, identifying the shocks by sign restrictions.

[17] Based on a VAR of the US.

[18] Sources: *Mandl (*2008*)*, *IEF (2009)*, *IFB (2011)*, *Bjuggren et al. (2011)* and *Lindow (2013)*.

[19] Regarding the number of firms, the share of family firms is even larger, see for example *La Porta et al. (*1999*)* and *Mandl (*2008*)*.

Unemployment (%)			
Countries with above-average family firm share in labor force		Countries with below-average family firm share in labor force	
Austria	3.71	Finland	6.62
Estonia	9.05	Netherlands	3.35
France	7.68	Norway	2.49
Germany	8.04	Romania	5.43
Hungary	6.86	Slovenia	5.48
Ireland	7.46	Sweden	7.02
Italy	8.19	UK	4.32
Spain	13.69		
Average 8.09		Average 4.96	
Average 6.63			

Table 2: Unemployment rate by share of family firms in the European labor force

In addition, the level of unemployment is, on average, lower in countries where there are fewer family firms (Table 2), 5.0 percent compared to 8.1 percent otherwise.[20]

Despite their remarkable labor market share, family firms have not attracted much macroeconomic research attention.[21] At the same time, many of their characteristics are documented in the corporate finance literature, based on firm-level data.

First, family firms behave differently in the labor market, compared to non-family firms. On the one hand, job security is stronger among family firms.[22] *Bassanini et al. (*2011*)* use matched employer-employee data of French companies, and find that the dismissal rate of family firms is lower, and so is the subjective risk of dismissal perceived by the workers. Also, family firms rely less on dismissal and more on reducing hiring when they have to cut their number of employees.

*Sraer-Thesmar (*2007*)*, using a French sample of stock exchange-listed companies, point out that family firms pay lower wages, even after controlling for the skill and age structure of the workers. Similarly, *Bassanini et al. (*2011*)* show that family firms pay a lower wage on average than do non-family firms, and this is due to differences in unoberserved characteristics of family and non-family owned enterprises. Furthermore, when a firm becomes non-family owned, its wages drop.

[20]The author's calculation based on Eurostat data between 2000 and 2012, and *Mandl (*2008*)*, *IEF (2009)*, *IFB (2011)*, *Bjuggren et al. (2011)* and *Lindow (2013)*.

[21]Regarding the macroeconomic relevance of family firms, I am aware of only a single paper, *Caselli-Gennaioli (*2013*)*, which treats this topic. Based on a simple growth model, these authors claim a relationship between family management and the health of financial markets; that is, the worse a financial market is functioning, the greater number of family-managed firms there will be. This and the claim that family managers are less talented at running firms imply that the share of family firms is important in explaining cross-country income differences. However, these researchers do not talk about the labor market. Recently, *Epstein-Shapiro (*2014*)* studied labor market policies in a model with small and large firms. However, they did not consider fiscal consolidation policies, and they focused only on firm size, rather than including other firm characteristics.

[22]Furthermore, not only is the job security of family firms greater, but these firms are also less likely to exit the market (*Nunes et al.,* 2014).

Moreover, worker influence on wage setting is lower in family firms. Still, employees of family firms, compared to their counterparts in the non-family sector, are more loyal to their employers. *Siebert et al. (*2011*)* claim that this greater loyalty stems from long-term employment.

Second, as *Caselli-Gennaioli (*2013*)* point out, "inter-generational transmission of managerial responsibilities", ie. dynastic management, is crucial for family firms. The current owner or manager ("the son") of the firm inherits managerial know-how - related to customers, suppliers and other market operators - from the previous owner or manager ("the father").

There is no consensus in the literature, however, as to whether family firms are more or less productive than non-family firms. *Bennedsen et al. (*2007*)* claim that family management has a negative impact on firm performance. However, *Maury (*2006*)* and others, *Anderson-Reeb (*2003*)*, *Villalonga-Amit (*2006*)* and *King-Santor (*2007*)*, find that the relationship between family management and firm performance is not monotonic.

A general misunderstanding about family firms is that all of them are small.[23] As *Mandl (*2008*)* highlights, the family business sector is mainly dominated by small- and medium-sized companies. However, some of the largest firms are also family firms. Examples of these are Volkswagen, Metro or Bosch.[24] Also, as *IFERA (*2003*)* claims, not only is Wal-Mart, one of the largest companies of the world, a family company, but further 35 percent of the 500 biggest US companies are family firms. Figure 1 shows an overview of the size structure of European (family) firms.

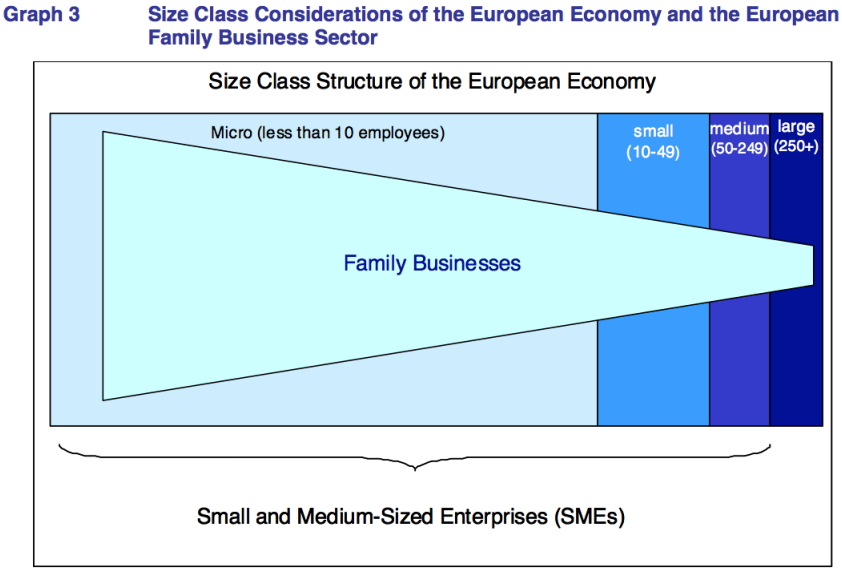

Figure 1: Size structure of European (family) firms (*Mandl, 2008*, page 50)

[23] According to the Eurostat, a micro or small firm employs fewer than 50 people, a medium-sized firm employs between 50 and 249 people, while a large enterprise has at least 250 employees.

[24] http://www.campdenfb.com/article/top-100-family-businesses-europe-1

When considering employment or turnover instead of number of firms, the dominance of small firms among family firms is even lower. According to *Mandl (*2008*)*, the share of family firms with an annual turnover higher than EUR 50 million is 34 percent in Germany. Also, in Ireland 27.1 percent and in Finland 22 percent of large firms are family firms. In the UK, the share of large firms in the family sector is also notable, although it is lower (15.6 percent, *IFB,* 2011). In Italy, the average number of employed people is 68 in the family sector and 305 in the non-family sector, based on *Navaretti et al. (*2008*)*.

Another common misperception is that family firms are not export-oriented. According to *IFB (*2011*)*, in the UK, 19 percent of family firms sold exports last year, while the relevant non-family value is a bit lower, 15 percent. Regarding Spain, both the export propensities and the export intensities of family and non-family firms are very similar (71.1 and 68.8, and 20.9 and 25.3 percents, respectively), as shown by *Merino et al. (*2012*)*. Similar conclusions can be drawn for Italy (*Navaretti et al.,* 2008 and *Minetti et al.,* 2013).

1.3 Outline of the paper

Thus, our incomplete knowledge of unemployment fiscal multipliers motivates my work in this paper. Concerning the expenditure side, the evidence is mixed about both the sign and the magnitude. Moreover, there are not yet any unemloyment multipliers of tax policies. This, together with the fact that family firms employ a notable share of the labor force in Europe, and that these firms behave differently than non-family firms in the labor market brought me to my present goal: to estimate unemployment multipliers of expenditure and revenue-side fiscal consolidation policies in the presence of sectoral heterogeneity, ie. in the presence of family and non-family firms.

Specifically, I develop a model, based on a standard, closed-economy New Keynesian framework with search and matching frictions, as an innovation, with sectoral heterogeneity, ie. family and non-family firms. I concentrate on the different labor market behavior of family firms, as well as introduce an intangible capital[25] in the family sector, which enables me to model the dynastic management of family firms. The presence of the two sectors creates the possibility of sectoral movements due to changes in relative sectoral prices and wages. For the purpose of illustration, the model is calibrated to match data of those European countries where family firms have an above-average presence in the labor market.

My model predicts that fiscal austerity raises unemployment. At peak, the highest increase in unemployment is implied by a cut in government consumption. Nevertheless, an increase in employees' labor income tax, cumulatively, implies the same size increase in unemployment as does the government consumption cut. A higher employer social security contribution is, however, less costly in terms employment than an increase on the same scale in the tax on employees' labor income. Both at peak and cumulatively, unemployment reacts least when the budget is consolidated by

[25]In this paper the terms 'organisational', 'family', 'family organisational' and 'intangible capital' are used interchangeably.

increasing the rate of value-added tax. Yet, a policymaker must manage trade-offs, as the increase in value-added tax results in the steepest decline in consumption.

Sectoral heterogeneity seems to play a crucial role: unemployment fiscal multipliers are very different with and without it. When homogeneous firms are considered, multipliers of labor income tax policies and government consumption multipliers are usually biased downwards, while consumption tax multipliers are often biased upwards. Thus, ignoring sectoral heterogeneity might lead to incorrect policy conclusions, although, according to my results, budget consolidation is always least harmful for employment when it is implemented by increasing consumption tax revenue.

Regarding the existing literature, qualitatively, my results are in line with those of authors who suggest that tightening fiscal policy on the expenditure side increases unemployment. As regards the size of the unemployment multiplier of government consumption, it is close to *Monacelli et al. (*2010*)*. Moreover, my results are consistent with *Ball et al. (*2013*)* who show that spending-based adjustments have a more pronounced effect on unemployment than tax-based adjustments (only at peak, however). But, as they use a narrative approach, they are not able to compare different tax policies (as I am). To the best of my knowledge, this is the first paper to provide estimates of unemployment multipliers of tax policies. Finally, sectoral heterogeneity on the firm side - alongside labor force participation and short- and long-term unemployment, suggested by *Bermperoglou et al. (*2013*)* - might be another explanation of the gap between theoretical and empirical multipliers reported, but unexplained by *Monacelli et al. (*2010*)*.

The structure of the paper is as follows. The next section describes the model, while calibration is presented in Section 3. Results appear in Section 4. Section 5 concludes, while the Appendix provides more detail on impulse response functions and the sensitivity of the results.

2 Modeling framework

My model builds on a standard, closed-economy dynamic stochastic general equilibrium (DSGE) framework with price stickiness (*Rotemberg,* 1982) and search and matching frictions (*Gertler et al.,* 2008 and *Staehler-Thomas,* 2012).

As an innovation, there is sectoral heterogeneity on the firm side, ie. family and non-family firms are distinguished. Family firms behave differently in the labor market than non-family firms by providing greater job security, but lower wages and less bargaining power to their employees. As well, dynastic management of family firms is modeled by the inclusion of an intangible capital in the family sector, following *Danthine-Jin (*2007*)*.[26] The presence of the two sectors creates the possibility of sectoral movements due to changes in relative sectoral prices and wages.

[26]Other examples of intangible capital include *McGrattan-Prescott (*2000*)*, *Ai et al. (*2013*)*, *Gourio-Rudanko (*2014*)* or *McGrattan-Prescott (*2014*)*.

2.1 Representative household

A representative household maximizes expected discounted lifetime utility:

$$E_0 \sum_{t=0}^{\infty} \beta^t u\left(C_t\right)$$

Here, β is the usual deterministic discount factor. For simplicity's sake, I assume that the household only derives utility from aggregate consumption C_t. [27]

The household's contemporaneous utility is a constant relative risk aversion (CRRA) function of aggregate consumption:

$$u\left(C_t\right) = \frac{\left(C_t - hC_{t-1}\right)^{1-\sigma_C} - 1}{1-\sigma_C}$$

where h is the external habit parameter and σ_C is the relative risk aversion parameter.

There is unemployment due to search and matching frictions, which I will describe in more detail later on. A member of the household might work in the intermediate family sector ($L_{F,t}$) or in the intermediate non-family sector ($L_{NF,t}$). If the household member is not employed in any of these sectors, he/she is unemployed. I define the beginning of period unemployment by U_t:

$$U_t = 1 - L_{F,t-1} - L_{NF,t-1}$$

Here, I normalise the total number of labor force to one, meaning I do not take into account labor force participation decision. [28]

When working in the family or in the non-family sector, the household receives labor income, $W_{F,t}$ and $W_{NF,t}$, respectively. These are sectoral real wages, expressed in the economy-wide price level P_t. Labor income is taxed in both sectors by $\tau_{LEE,t}$, which is the sum of personal labor income tax and the employees' social security contribution. While the social security contribution is deducted, modeling retirement is beyond the scope of this paper. When unemployed, the household member receives W_U unemployment benefit, also expressed in the economy-wide price level.

Because the household owns the firms, the household receives the dividends. The household owns and rents physical capital to intermediate family and non-family firms, $K_{F,t}$ and $K_{NF,t}$, so he/she receives rental rate of capital, $RK_{F,t}$ and $RK_{NF,t}$, respectively. The rental rates differ in the two sectors, and are also expressed in terms of the economy-wide price level. The household can save either in a risk-free government bond B_t, after which he/she gets i_{t-1} nominal interest rate, deflated by π_t quarterly inflation rate, or she can invest into physical capital. To avoid jumps, investment is subject to an adjustment cost following *Christiano et al. (*2005*)*:

$$K_{F,t} = (1-\delta_F)K_{F,t-1} + I_{F,t} - \frac{\phi^{IF}}{2}\left(\frac{I_{F,t}}{I_{F,t-1}} - 1\right)^2 I_{F,t}$$

[27] See, for example, *Gertler et al. (*2008*)*.

[28] A recent example of a model with labor force participation is *Bermperoglou et al. (*2013*)*.

Here, $I_{F,t}$ denotes investment into family physical capital, δ_F is the family depreciation rate, and ϕ^{IF} is the investment adjustment cost related to family physical capital. Investment adjustment cost is zero in steady state.[29]

The household consumes an aggregate consumption bundle C_t, which will be described in more detail shortly, and after her consumption she pays value-added tax $\tau_{C,t}$, and a lump sum tax T_t to close the model. For simplicity, I assume that income related to bonds or physical capital renting are not taxed. [30]

Thus, the period-by-period household budget constraint is

$$(1-\tau_{LEE,t})\left(W_{F,t}L_{F,t}+W_{NF,t}L_{NFt}\right)+W_U(1-L_{F,t}-L_{NF,t})+\frac{1+i_{t-1}}{\pi_t}B_{t-1}+$$
$$+RK_{F,t}K_{F,t-1}+RK_{NF,t}K_{NF,t-1}+Prof^I_{F,t}+Prof^I_{NF,t}+\frac{P_{F,t}}{P_t}Prof^F_{F,t}+$$
$$+\frac{P_{NF,t}}{P_t}Prof^F_{NF,t}=(1+\tau_{C,t})C_t+\frac{P_{F,t}}{P_t}I_{F,t}+\frac{P_{NF,t}}{P_t}I_{NF,t}+B_t+T_t$$

Here, $P_{F,t}$ ($P_{NF,t}$) is the price level of the goods produced in the family (non-family) sector. As the budget constraint is expressed in terms of the aggregate price level P_t, the relative sectoral prices are considered regarding sectoral investments (the same is true of final firms' profits).

The household maximises its expected discounted lifetime utility subject to its budget constraint and the two physical capital laws of motion with respect to B_t, C_t, $I_{F,t}$, $I_{NF,t}$, $K_{F,t}$ and $K_{NF,t}$. The household takes wages and labor as given, as these are determined in the labor market when bargaining with intermediate firms.

Optimization yields the usual Euler equation:

$$E_t\left[\beta\frac{1+i_t}{\pi_{t+1}}\frac{1}{1+\tau_{C,t+1}}\frac{1}{C_{t+1}}\right]=\frac{1}{1+\tau_{C,t}}\frac{1}{C_t}$$

Because there is a value-added tax, the current and next period tax levels affect the intertemporal consumption choice of the household.

The family physical capital and investment decisions of the household can be expressed by two equations, a Tobin-Q and an arbitrage condition:[31]

$$\frac{P_{F,t}}{P_t}=Q_{F,t}-Q_{F,t}\frac{\phi^{IF}}{2}\left(3\frac{I^2_{F,t}}{I^2_{F,t-1}}-4\frac{I_{F,t}}{I_{F,t-1}}+1\right)+E_t\left[Q_{F,t+1}\phi^{IF}\frac{\pi_t}{i_{t+1}}\left(\frac{I^3_{F,t+1}}{I^3_{F,t}}-\frac{I^2_{F,t+1}}{I^2_{F,t}}\right)\right]$$

$$E_t\left[\frac{1+i_t}{\pi_{t+1}}\right]=E_t\left[\frac{RK_{F,t}+(1-\delta_F)Q_{F,t+1}}{Q_{F,t}}\right]$$

[29] Similarly in the non-family sector.

[30] A counterexample is e.g. *Staehler-Thomas (*2012*)*.

[31] Here, I describe the family sector, the non-family sector is similar.

$Q_{F,t}$ is the price level of family physical capital, which is related to the Lagrangian multiplier of the relevant law of motion. A Tobin-Q of a standard, one-sector model does not contain any relative prices. However, because there are two sectors here, the relative sectoral prices appear in the Tobin-Q. Thus, in steady state, the price level of family physical capital is equal to the relative price of family goods, instead of 1 of the usual one-sector framework. Furthermore, the arbitrage condition is also affected by the sectoral price level; in steady state the rental rate of capital is thus not equal to the real interest rate net depreciation rate, but it is also affected by the sectoral Tobin-Q.

Finally, I_t aggregate investment is defined as follows:

$$I_t = \frac{P_{F,t}}{P_t} I_{F,t} + \frac{P_{F,t}}{P_t} I_{NF,t}$$

Aggregate household consumption is a composite of goods produced by family and non-family firms:

$$C_t = \left[\gamma^{\frac{1}{\eta}} C_{F,t}^{\frac{\eta-1}{\eta}} + (1-\gamma)^{\frac{1}{\eta}} C_{NF,t}^{\frac{\eta-1}{\eta}} \right]^{\frac{\eta}{\eta-1}}$$

γ is the share of family-firm produced goods in the consumption basket, while η is the elasticity of substitution between family and non-family firm produced goods.

The household minimizes its expenditure spent on consumption goods, taking into account the composite consumption function above. As a result, the demand functions for consumption of family and non-family produced goods are

$$C_{F,t} = \gamma \left(\frac{P_{F,t}}{P_t} \right)^{-\eta} C_t \qquad C_{NF,t} = (1-\gamma) \left(\frac{P_{NF,t}}{P_t} \right)^{-\eta} C_t$$

The economy-wide price level P_t, which is the Lagrangian multiplier of the above maximization problem, can be expressed as a composite of the sectoral price levels:

$$P_t = \left[\gamma P_{F,t}^{1-\eta} + (1-\gamma) P_{NF,t}^{1-\eta} \right]^{\frac{1}{1-\eta}}$$

Finally, the stochastic discount factor is, as usual, $\beta_{t,t+1} = E_t \left[\beta \frac{\frac{\partial u(C_{t+1})}{\partial C_{t+1}}}{\frac{\partial u(C_t)}{\partial C_t}} \right]$

2.2 Intermediate good producing firms and wage bargaining

In each sector, there is a continuum of intermediate goods-producing firms, which are perfectly competitive, ie. they take prices as given. They produce goods hiring labor (as well as the employer social security contribution $\tau_{LER,t}$) and renting physical capital from the household. Hiring labor requires posting vacancies, which is costly, and so induces unemployment.

Also, intermediate firms bargain over wages with workers. Modeling the labor market is similar to *Gertler et al. (*2008*)* and *Staehler-Thomas (*2012*)*. Based on empirical, firm-level evidence, family firms behave differently in the labor market than non-family firms: i) their dismissal rate is lower, ii) their workers obtain a lower wage (in steady state) and iii) their workers have less bargaining power in wage setting. Moreover, family firms invest in family capital, which non-family firms do not do. This capital, an intangible one in accordance with *Danthine-Jin (*2007*)*, represents the dynastic management of family firms. At this point, I will describe the intermediate firms in detail.[32]

The sectoral production functions are

$$\begin{aligned} Y^I_{F,t} &= A_{F,t} L^{\alpha_F}_{F,t} K^{1-\alpha_F-\mu}_{F,t-1} K^{\mu}_{OF,t-1} \\ Y^I_{NF,t} &= A_{NF,t} L^{\alpha_{NF}}_{NF,t} K^{1-\alpha_{NF}}_{NF,t-1} \end{aligned}$$

These are, for simplicity's sake, Cobb-Douglas functions with constant returns to scale.[33] α_F and α_{NF} denote labor income shares in the two sectors, respectively. $A_{F,t}$ and $A_{NF,t}$ are exogenous productivity levels, which are assumed to be equal in the steady state:

$$\hat{A_{F,t}} = \rho_{AF} \hat{A_{F,t-1}} + \epsilon_{AF,t} \qquad \hat{A_{NF,t}} = \rho_{ANF} \hat{A_{NF,t-1}} + \epsilon_{ANF,t}$$

In the family sector the family capital, which represents dynastic management, is denoted by $K_{OF,t-1}$. Investment in family organisational capital follows a law of motion:

$$K_{OF,t} = (1-\delta_{OF}) K_{OF,t-1} + \theta I_{OF,t} - \frac{\phi^{IOF}}{2} \left(\frac{I_{OF,t}}{I_{OF,t-1}} - 1 \right)^2 I_{OF,t}$$

This is similar to the physical capital law of motion described above. Nevertheless, parameter θ appears, which represents the effectiveness of family organisational investment. In the baseline scenario, this parameter is set to 1. Family organisational investment $I_{OF,t}$ is intangible, so it is not part of the final output. This creates a trade-off, namely, investment in family capital reduces goods sold today as well as profit today, but it increases the next period's family organisational capital stock, thus bringing about future production and profit.

Family firms post vacancies, v^F_t. The number of new hires (matches), m^F_t, depends on the number of vacancies posted and the number of people searching for a job, U^s_t. Searching can be described by a matching function:

$$m^F_t = \sigma_{F,m} (U^s_t)^{\sigma_F} (v^F_t)^{1-\sigma_F}$$

Here, $\sigma_{F,m}$ is the matching efficiency, while σ_F denotes the matching elasticity.

[32] I focus on the family sector; the non-family sector, except for the organisational capital, is parallel.

[33] Following the intangible capital literature, such as *McGrattan-Prescott (*2010*)* and *McGrattan-Prescott (*2014*)*, constant returns to scale mean constant returns to scale in all production inputs, including the intangible capital.

Similarly to *Staehler-Thomas (*2012*)*, but in contrast to *Gertler et al. (*2008*)* I assume that the number of people searching for a job in period t equals the number of people who are unemployed at the end of period $t-1$ (U_t) plus the number of people losing their job at the beginning of period t:

$$U_t^s = U_t + (1-\rho^F)L_{F,t-1} + (1-\rho^{NF})L_{NF,t-1}$$

Those who are fired can immediately start to search for a new job. Firing is exogenous: the sectoral dismissal rates are ρ^F and ρ^{NF}. Furthermore, everyone can search for a job in any of the sectors, not only in the sector in which one was working previously.

Those who find a job in period t start to work immediately. The same assumption is made by *Gertler et al. (*2008*)* and *Staehler-Thomas (*2012*)*, but *Bermperoglou et al. (*2013*)* assume that those who find a job in period t start to work in period $t+1$ only. Given the above functional forms and assumptions, the family labor law of motion is

$$L_{F,t} = \rho^F L_{F,t-1} + m_t^F$$

Finally, family vacancy filling and job finding probabilities are defined as

$$q_t^F = \frac{m_t^F}{v_t^F} \quad p_t^F = \frac{m_t^F}{U_t^s}$$

Regarding vacancy posting, κ^F and κ^{NF} denote per-vacancy costs. Total vacancy cost is linear in the number of vacancies posted. Also, this is the only cost in my framework. In contrast, *Staehler-Thomas (*2012*)* consider a training cost as well. Regarding the functional form, *Gertler et al. (*2008*)* do not use a linear function. This is because they assume nominal wage rigidity, which requires a quadratic function. I follow most of the literature when considering a linear function. Hence, my framework is the closest to that of *Bermperoglou et al. (*2013*)*.

Intermediate profits are

$$\begin{aligned} Prof_{F,t}^I &= MC_{F,t}Y_{F,t}^I - (1+\tau_{LER,t})W_{F,t}L_{F,t} - RK_{F,t}K_{F,t-1} - \kappa^F \frac{P_{F,t}}{P_t} v_t^F - MCF_t I_{OF,t} \\ Prof_{NF,t}^I &= MC_{NF,t}Y_{NF,t}^I - (1+\tau_{LER,t})W_{NF,t}L_{NF,t} - RK_{NF,t}K_{NF,t-1} - \kappa^{NF} \frac{P_{NF,t}}{P_t} v_t^{NF} \end{aligned}$$

Because intermediate firms are perfectly competitive, the price of goods is equal to the real marginal cost, $MC_{F,t}$ and $MC_{NF,t}$ in the two sectors, respectively. Profit equals revenue net wages and rental rate of capital. Vacancy posting costs are deducted, as well. Because there are two sectors and the profits are expressed in the economy-wide price level P_t, relative sectoral prices are taken into account when calculating total vacancy posting costs. The last term in the family profit is related to family organisational investment. Specifically, some part of family production, $I_{OF,t}$, is not sold in the market, but it is used by the firm itself as investment in organisational capital to enhance future production. Because the family firm invests in organisational capital itself, the price of investment equals the price of goods produced.

Intermediate firms maximize their expected discounted lifetime profit by choosing labor, number of vacancies and physical capital, taking into account the production functions and labor laws of motion above:

$$E_0 \sum_{j=0}^{\infty} \beta_{t,t+j} Prof^I_{F,t+j} \quad E_0 \sum_{j=0}^{\infty} \beta_{t,t+j} Prof^I_{NF,t+j}$$

$\beta_{t,t+j}$ denotes the stochastic discount factor of the household between periods t and $t+j$.

Optimization implies a usual physical capital demand:

$$RK_{F,t} = MC_{F,t}(1-\alpha_F-\mu)\frac{Y^I_{F,t}}{K_{F,t-1}}$$

Demand for labor, however, differs from the standard one without labor market frictions, namely, current and next period firm values have an effect on the real wage:

$$(1+\tau_{LER,t})W_{F,t} = MC_{F,t}\alpha_F \frac{Y^I_{F,t}}{L_{F,t}} - F_{F,t} + E_t\left[\beta_{t,t+1}\rho^F F_{F,t+1}\right]$$

where the current firm value $F_{F,t}$ is related to the vacancy posting cost:

$$F_{F,t} = \kappa^F \frac{P_{F,t}}{P_t}\frac{1}{q^F_t}$$

Combining these two yields the wage setting equation:

$$(1+\tau_{LER,t})W_{F,t} = MC_{F,t}\alpha_F \frac{Y^I_{F,t}}{L_{F,t}} - \kappa^F \frac{P_{F,t}}{P_t}\frac{1}{q^F_t} + E_t\left[\beta_{t,t+1}\rho^F\kappa^F \frac{P_{F,t+1}}{P_{t+1}}\frac{1}{q^F_{t+1}}\right]$$

Additionally, only in the family sector, there is a demand for organisational capital:

$$Q_{OF,t} - E_t\left[\beta_{t,t+1}(1-\delta_{OF})Q_{OF,t+1}\right] = E_t\left[\beta_{t,t+1}MC_{F,t+1}\mu\frac{Y^I_{F,t+1}}{K_{OF,t}}\right]$$

In contrast to the family physical capital demand, rather than the current period's production, the next period's production is relevant. This is because the firm decides about the next period's organisational capital today, taking this period's organisational capital as given. Also, this is the reason that both the current period's and also the next period's capital prices appear.

Similarly to physical capital, there is also a Tobin-Q for family organisational capital:

$$MC_{F,t} = \theta Q_{OF,t} - Q_{OF,t}\frac{\phi^{IOF}}{2}\left(3\frac{I^2_{OF,t}}{I^2_{OF,t-1}} - 4\frac{I_{OF,t}}{I_{OF,t-1}} + 1\right) +$$
$$+E_t\left[\beta_{t,t+1}Q_{OF,t+1}\phi^{IOF}\left(\frac{I^3_{OF,t+1}}{I^3_{OF,t}} - \frac{I^2_{OF,t+1}}{I^2_{OF,t}}\right)\right]$$

θ, the effectiveness of family organisational investment has an impact on the price of family organisational capital. In steady state, the price of family capital is equal to $\frac{MC_F}{\theta}$, so the higher the effectiveness of organisational investment, the lower the price of family organisational capital. Again, the price of family capital is related to the price of production, as the family firm sacrifices its own goods to invest in this inheritable special knowlegde.

Intermediate firms and workers bargain over gross wages; in period t they bargain over wages paid in period t. Bargaining happens after matching is over. My framework closely follows that of *Staehler-Thomas (*2012*)*. Rearranging labor demand gives the firm value:

$$F_{F,t} = MC_{F,t}\alpha_F \frac{Y^I_{F,t}}{L_{F,t}} - (1+\tau_{LER,t})W_{F,t} + E_t\left[\beta_{t,t+1}\rho^F F_{F,t+1}\right]$$

The current firm value depends on the difference between the marginal revenue of the firm net wage (affected by employer social security contribution), while it is also related to next period's firm value, taking into account the dismissal rate of workers.

Worker value of working in the family sector at the end of period t is equal to the wage received by the worker in period t (affected by employee labor income tax rate) and the discounted worker value in period $t+1$. This latter is a sum of remaining employed in the family sector with probability ρ^F, plus the value of being unemployed at the beginning of period $t+1$ with probability of losing the job:

$$V_{F,t} = (1-\tau_{LEE,t})W_{F,t} + E_t\left[\beta_{t,t+1}\left(\rho^F V_{F,t+1} + (1-\rho^F)UV_{b,t+1}\right)\right]$$

The value of searching for a job at the begining of period t:

$$UV_{b,t} = p^F_t V_{F,t} + p^{NF}_t V_{NF,t} + (1-p^F_t - p^F_t)UV_{e,t}$$

With probability p^F_t the unemployed person finds a job in the family sector, with probability p^{NF}_t he/she finds a job in the non-family sector, while with probability $1-p^F_t-p^F_t$ at the end of period t he/she is still unemployed. Those who are unemployed at the end of period t receive unemployment benefits from the government, and can search again in the next period:

$$UV_{e,t} = W_U + E_t\left[\beta_{t,t+1}UV_{b,t+1}\right]$$

Workers and intermediate firms bargain over the net surplus in the two sectors separately, family bargaining means maximizing the following expression with respect to the gross wage:

$$max\left(V_{F,t}(W_{F,t}) - UV_{e,t}\right)^{\lambda_F} F_{F,t}(W_{F,t})^{1-\lambda_F}$$

where λ_F is the bargaining powers of workers in the family sector. Optimization implies

$$\lambda^F(1-\tau_{LEE,t})F_{F,t} = (1-\lambda^F)(1+\tau_{LER,t})(V_{F,t} - UV_{e,t})$$

2.3 Final good producing firms

Similarly to *Gertler et al. (*2008*)*, in each sector there is a continuum of $(0,1)$ final goods-producing firms which set final goods prices. I present the family sector only, as the non-family sector is parallel.

Final firm s in the family sector sells $Y_{F,t}^F(s)$ amount of final goods at price $P_{F,t}(s)$. Total final output is a Dixit-Stiglitz aggregator (*Dixit-Stiglitz,* 1977) of $s \in (0,1)$ final goods with family markup equal to $\frac{\epsilon_F}{\epsilon_F - 1}$:

$$Y_{F,t}^F = \left(\int_0^1 Y_{F,t}^F(s)^{\frac{\epsilon_F - 1}{\epsilon_F}} ds \right)^{\frac{\epsilon_F}{\epsilon_F - 1}}$$

Then, optimization yields a demand function for each final good s:

$$Y_{F,t}^F(s) = \left(\frac{P_{F,t}}{P_{F,t}(s)} \right)^{\epsilon_F} Y_{F,t}^F$$

while the total final good price is a function of $s \in (0,1)$ final good prices:

$$P_{F,t} = \left(\int_0^1 P_{F,t}(s)^{1-\epsilon_F} ds \right)^{\frac{1}{1-\epsilon_F}}$$

As prices are sticky, firms must pay a quadratic cost when changing prices, following *Rotemberg (*1982*)*. This cost is zero in the steady state, but around the steady state it varies depending on the ratio of the current price level to the previous period's price level of final firm s. Thus, the profit of final firm s expressed in $P_{F,t}$ price level is

$$Prof_{F,t}^F(s) = \frac{P_{F,t}(s) - MC_{F,t} P_t}{P_{F,t}} Y_{F,t}^F(s) - \frac{\phi^F}{2} \left(\frac{\frac{P_{F,t}(s)}{P_{F,t-1}(s)}}{\pi} - 1 \right)^2 Y_{F,t}^F$$

ϕ^F is the price rigidity parameter, and π is the economy wide steady state quarterly inflation rate.

Final firms maximize expected discounted lifetime profit with respect to $P_{F,t}(s)$ given the demand function above:

$$E_0 \sum_{j=0}^{\infty} \beta_{t,t+j} Prof_{F,t+j}^F(s)$$

Then, the optimal pricing decision is

$$\phi^F \left(\frac{\pi_t^F}{\pi} - 1 \right) \frac{\pi_t^F}{\pi} = 1 - \epsilon_F + \epsilon_F \frac{MC_{F,t}}{\frac{P_{F,t}}{P_t}} + E_t \left[\beta_{t,t+1} \phi^F \left(\frac{\pi_{t+1}^F}{\pi} - 1 \right) \frac{\pi_{t+1}^F}{\pi} \frac{Y_{F,t+1}^F}{Y_{F,t}^F} \right]$$

where $\pi_t^F = \frac{P_{F,t}}{P_{F,t-1}}$ is the sectoral inflation rate.

After loglinearising and rearranging the pricing decisions, the sectoral New-Keynesian Philips curves are

$$\hat{\pi_t^F} = \frac{\epsilon_F MC_F}{\phi^F \frac{P_F}{P}} \left(\hat{MC}_{F,t} - \hat{PFP}_t \right) + E_t \left[\beta \hat{\pi_{t+1}^F} \right]$$
$$\hat{\pi_t^{NF}} = \frac{\epsilon_F MC_{NF}}{\phi^{NF} \frac{P_{NF}}{P}} \left(\hat{MC}_{NF,t} - \hat{PNFP}_t \right) + E_t \left[\beta \hat{\pi_{t+1}^{NF}} \right]$$

with $PFP_t = \frac{P_{F,t}}{P_t}$ and $PNFP_t = \frac{P_{NF,t}}{P_t}$. These Philips curves are similar to the standard Philips curve, apart from the fact that they contain relative sectoral prices. Substituting $P_{F,t} = P_t$ and $P_{NF,t} = P_t$ (ie. $\hat{PFP}_t = 0$ and $\hat{PFP}_t = 0$) into the sectoral Philips-curves, one can immediately see that we get back the standard Philips curve.

2.4 Monetary authority

The central bank sets the next period's interest rate based on the current period inflation, following a simple Taylor rule:

$$\hat{i_t} = \rho_\pi \hat{\pi}_t + \epsilon_t^i$$

where ρ_π is the weight on inflation in the Taylor rule and ϵ_t^i is an exogenous monetary policy shock.

2.5 Government

The government collects taxes: labor income taxes (personal labor income tax and social security contribution of employees, and social security contribution of employers), a value-added tax and a lump-sum tax. For purposes of simplicity, I assume that interest income of bond holdings and income on physical capital renting are not taxed. Taxes finance government consumption expenditure G_t and unemployment benefit expenditure. Revenues and expenditures are

$$\begin{aligned} Rev_t &= (\tau_{LEE,t} + \tau_{LER,t}) (W_{F,t} L_{F,t} + W_{NF,t} L_{NF,t}) + \tau_{C,t} C_t + T_t \\ Exp_t &= G_t + W_U (1 - L_{F,t} - L_{NF,t}) \end{aligned}$$

Then, government deficit is defined as the difference between expenditures and revenues. The government issues bonds to finance its deficit, which are bought by the household.

$$DEF_t = Exp_t - Rev_t$$
$$DEF_t = B_t - \frac{1 + i_{t-1}}{\pi_t} B_{t-1}$$

In order to avoid an explosive solution, there is a lump-sum tax rule which depends on the government debt-output ratio, following *Bermperoglou et al. (*2013*)*:

$$T_t = T (T_{t-1})^{\rho_T} \left(\frac{\frac{B_{t-1}}{Y_t}}{\frac{B}{Y}} \right)^{(1-\rho_T)\xi_B} exp(\epsilon_{T,t})$$

Here, ρ_T is the autocorrelation parameter, ξ_B is the debt rule parameter representing the sensitivity of lump-sum taxes to the government debt-output ratio and $\epsilon_{T,t}$ is the shock. If the government debt to output ratio goes up compared to its steady state value, lump-sum tax increases.

Similarly to aggregate household consumption, aggregate government consumption is also a composite of goods produced by family and non-family firms:

$$G_t = \left[\gamma^{\frac{1}{\eta}} G_{F,t}^{\frac{\eta-1}{\eta}} + (1-\gamma)^{\frac{1}{\eta}} G_{NF,t}^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}$$

Demand functions follow

$$G_{F,t} = \gamma \left(\frac{P_{F,t}}{P_t}\right)^{-\eta} G_t \qquad G_{NF,t} = (1-\gamma)\left(\frac{P_{NF,t}}{P_t}\right)^{-\eta} G_t$$

For purposes of simplification, the share of family goods and the elasticity of substitution between family and non-family goods is the same as for household consumption, so the price levels are the same, too.

Finally, there is an exogenous shock process for each tax and expenditure item:

$$\begin{aligned}
\hat{\tau_{LEE,t}} &= \rho_{\tau LEE}\hat{\tau_{LEE,t-1}} + \epsilon_{\tau LEE,t} \\
\hat{\tau_{LER,t}} &= \rho_{\tau LER}\hat{\tau_{LER,t-1}} + \epsilon_{\tau LER,t} \\
\hat{\tau_{C,t}} &= \rho_{\tau C}\hat{\tau_{C,t-1}} + \epsilon_{\tau C,t} \\
\hat{G_t} &= \rho_G \hat{G_{t-1}} + \epsilon_{G,t}
\end{aligned}$$

with $\rho_{\tau LEE}$, $\rho_{\tau LER}$, $\rho_{\tau C}$, ρ_G autocorrelation parameters and $\epsilon_{\tau LEE,t}$, $\epsilon_{\tau LER,t}$, $\epsilon_{\tau C,t}$, $\epsilon_{G,t}$ shock error terms.

2.6 Market clearing

In equilibrium all markets clear. Physical capital markets clear, ie. physical capital supplied by the household is equal to physical capital demanded by intermediate firms. Similarly, labor markets clear.

Also, goods markets clear. Total final output is equal to total intermediate output:

$$Y_{F,t}^F = Y_{F,t}^I - I_{OF,t} \qquad Y_{NF,t}^F = Y_{NF,t}^I$$

Concerning family goods, family organisational investment must be subtracted from intermediate output, as it is not distributed, but used by the firm itself. This is in line with *Danthine-Jin (*2007*)*, who point out that, from an accounting point of view, GDP does not contain intangible investment due to the fact that it is treated as an expense. (This is true despite the fact that from an economical point of view it is not an expense.)

Also, output in each sector equals demand in each sector. Final output of family firms is equal to the sum of household and government consumption demand, and for physical investment demand for family firm-produced goods, too, there is a deadweight loss related to vacancy posting and price stickiness (non-family market clearing is similar).

$$Y_{F,t}^F = C_{F,t} + G_{F,t} + I_{F,t} + \kappa_F v_t^F + \frac{\phi^F}{2}\left(\frac{\pi_t^F}{\pi} - 1\right)^2 Y_{F,t}^F \frac{P_t}{P_{F,t}}$$

Finally, total output (GDP) is defined as:

$$P_t Y_t \;\; = \;\; P_{F,t} Y_{F,t}^F + P_{NF,t} Y_{NF,t}^F$$

3 Calibration

For the purpose of illustration, the model is calibrated to match data of those European countries with an above-average share of family firms in employment. The share of family firms in the labor force is 56.4 percent (Table 1) and the share of family firm produced goods in the household and government consumption basket is 0.6 based on *Mandl (*2008*)*. The unemployment rate is 8.1 percent, based on Eurostat data between 2000 and 2012 (Table 2).

The discount rate β is set to 0.99, which is a standard value in the literature. The steady-state quarterly rate of inflation is 0. Price markups are 10 percent in both sectors, and all the quarterly depreciation rates are 2.5 percent, following standard values in the literature. Family and non-family labor income shares are set to the common value of 0.7. The price elasticity of demand is assumed to be 1.5.

Both productivity levels are normalised to 1. There is no consensus in the corporate finance literature as to whether family firms are more or less productive than non-family firms[34]. For simplicity's sake, then, I consider the same levels, and after which I check the sensitivity of the results with respect to this.

The effectiveness of family organisational investment is 1, which, following *McGrattan-Prescott (*2010*)*, assumes that the accumulation process of intangible capital is the same as the usual accumulation process of physical capital. The sensitivity of the results with respect to this parameter is also examined later on.

The steady-state ratio of household consumption to GDP is 59.1 percent, based on Eurostat data of euro-area countries between 2000 and 2012.[35] The steady-state deficit to GDP ratio is 3 percent pursuant to the Maastrict Treaty. The steady-state value of the effective value-added tax rate is 12.4 percent, following the OECD and taking into account the great ratio of household consumption to GDP. Then, the steady state effective labor income tax rate of employees is 28.8 percent (including

[34]See Introduction for more detail.

[35]When calculating this ratio, GDP was modified by net exports and government investment, as my model is a closed economy and does not contain public investment.

personal labor income tax and social security contribution of employees), while the employer social security contribution rate is 24.2 percent.[36] These tax rates are similar to those of *Staehler-Thomas (*2012*)*.[37]

The gross steady-state replacement rate of unemployment benefit is 28 percent, following the OECD.[38] For this parameter, there is a wide range of values in the literature. The implied value of *Monacelli et al. (*2010*)* is only slightly above 10 percent, but *Christoffel et al. (*2009*)* set this rate to 65 percent, while *Esser et al. (*2009*)* suggest 50 percent. The most common value is around 0.3-0.4; usually, a lower value is considered for the US than for the euro area.[39]

Dynastic management, modeled by an intangible capital, connotes firm knowledge about customers, but also about suppliers. It is a latent variable that is difficult to measure, and I am unaware of any empirical estimates. *Gourio-Rudanko (*2014*)* claim that about 11 percent of employment is related to sales. They consider a similar value to calibrate the weight of customer capital, an intangible capital, representing the relationship between firms and customers. By assumption, I calibrate the level of organisational to physical capital in the family sector to 11 percent, following *Gourio-Rudanko (*2014*)*. I know that, by doing this, the relationship between the firm and its suppliers is not captured, and that the importance of family capital might therefore be even higher. Thus, I check the sensitivity of the results.

Also, I am unaware of any information concerning the ratio of sectoral price levels either. Nevertheless, *Bassanini et al. (*2011*)* find that the family wage is 5 percent lower than the non-family wage. Hence, I consider a similar gap between the sectoral price levels. *Sraer-Thesmar (*2007*)* find a similar wage penalty, about 4.5 percent, even though they did not consider non-listed companies as did *Bassanini et al. (*2011*)*.

*Bassanini et al. (*2011*)* is the sole paper that estimates dismissal rates. They find that the dismissal rate of family firms is 0.16 percentage points lower than the dismissal rate of non-family firms. Dismissal rates in the literature vary between 1.8 percent of *Bermperoglou et al. (*2013*)*, which is close to the estimated separation rates of *Hobijn-Sahin (*2007*)*, and the 10.5 percent of *Gertler et al. (*2008*)*, which is similar to the 8-10 percent reported by *Hall (*1995*)*. I set the non-family dismissal rate to 6 percent, which is the middle point, following *Staehler-Thomas (*2012*)*, and the family dismissal rate to 5.84 percent, taking into account the above-described finding of *Bassanini et al. (*2011*)*.

[36]These effective tax rates are based on OECD data between 2000 and 2012.

[37]Other papers usually consider only a lump sum tax, apart from *Bermperoglou et al. (*2013*)*.

[38]The gross replacement rate of unemployment benefit is also based on euro-area data between 2000 and 2012.

[39]It is not straightforward matter, however, how to compare the replacement rates, as some models only contain a lump-sum tax. This means that there is no clear distinction between gross and net wages and, thus, between gross and net unemployment benefit replacement rates.

Notation	Name	Value	Source
β	discount factor	0.99	standard
π	1 + quarterly inflation rate in SS	1	standard
$\varepsilon_F/(\varepsilon_F-1)$	F price markup	1.1	standard
$\varepsilon_{NF}/(\varepsilon_{NF}-1)$	NF price markup	1.1	standard
δ_F	F physical capital depreciation rate	0.025	standard
δ_{NF}	NF physical capital depreciation rate	0.025	standard
δ_{OF}	F organisational capital depreciation rate	0.025	standard
α_F	labor income share in F	0.7	standard
α_{NF}	labor income share in NF	0.7	standard
A_F	SS productivity level in F	1	simplifying assumption
A_{NF}	SS productivity level in NF	1	simplifying assumption
γ	share of family firm-produced goods in aggregate household/government consumption	0.6	Mandl (2008), IEF (2009), IFB (2011), Bjuggren et al (2011) and Lindow (2013), own calculation
θ	effectiveness of F organisational investment	1	simplifying assumption
C/Y	SS ratio of household consumption to output (%)	59.16	Eurostat, own calculation
DEF/Y	SS ratio of government deficit to output (%)	3	Maastricht criterium
L_F	SS F workforce (%)	51.88	Eurostat and Mandl (2008), IEF (2009), IFB (2011), Bjuggren et al (2011) and Lindow (2013), own calculation
L_{NF}	SS NF workforce (%)	40.04	Eurostat and Mandl (2008), IEF (2009), IFB (2011), Bjuggren et al (2011) and Lindow (2013), own calculation
U	SS unemployment rate (%)	8.09	Eurostat and Mandl (2008), IEF (2009), IFB (2011), Bjuggren et al (2011) and Lindow (2013), own calculation
τ_C	SS effective value added tax rate (%)	12.78	OECD, own calculation
$\tau_{L,EE}$	SS effective labor income tax rate (employee, includes personal income tax and social security contribution rate) (%)	28.81	OECD
$\tau_{L,ER}$	SS effective labor income tax rate (employer, includes social security contribution rate) (%)	24.16	OECD
b	ratio of unemployment benefit to SS average gross real wage (%)	28.03	OECD
P_F/P_{NF}	ratio of F price level to NF price level in SS	0.95	simplifying assumption, Bassanini et al (2011)
ρ_F	F dismissal rate	0.0584	Stahler-Thomas (2012) and Bassanini et al (2011)
ρ_{NF}	NF dismissal rate	0.06	Stahler-Thomas (2012)
K_{OF}/K_F	ratio of F organisational capital to F physical capital in SS	0.11	simplifying assumption, Gourio-Rudanko (2014)
λ_F	F bargaining power of workers	0.495	Bassanini et al (2011)
σ_F	F matching elasticity	0.495	Bassanini et al (2011) and Hosios (1990)
λ_{NF}	NF bargaining power workers	0.807	Bassanini et al (2011)
σ_{NF}	NF matching elasticity	0.807	Bassanini et al (2011) and Hosios (1990)
τ_K	SS effective capital income tax rate (%)	20	Mendoza et al (2014)
δ_K	tax allowance for a fraction of depreciation cost	0.22	Mendoza et al (2014)
η	price elasticity of demand	1.5	assumption
κ_F/W_F	ratio of F vacancy cost to SS F gross real wage	0.07	assumption
κ_{NF}/W_{NF}	ratio of NF vacancy cost to SS NF gross real wage	0.07	assumption

F stands for family firm, NF stands for non-family and SS stands for steady state.

Table 3: Steady state parameters

*Bassanini et al. (*2011*)* also show evidence that the bargaining power of workers, ie. the importance of unions, is higher in the non-family sector, 0.807, compared to the family sector, where it is only 0.495. *Hosios (*1990*)* claims that an efficient solution requires that the bargaining power of workers is equal to the matching elasticity in the matching function; therefore, I set the sectoral matching elasticities accordingly. My non-family bargaining power is higher than the usual values of 0.3-0.5 found in the literature (*Mortensen-Nagypal,* 2007), apart from *Gertler et al. (*2008*)* who estimate a value of slightly more than 0.9. Most papers, following *Hosios (*1990*)*, set the matching elasticity equal to the bargaining power of workers, except *Gertler et al. (*2008*)* who calibrate the matching elasticity to 0.5. Moreover, *Christoffel et al. (*2009*)* consider a somewhat higher matching elasticity than their bargaining power of workers (0.6 and 0.5, respectively).

Similarly to the dismissal rates, there is a wide range of values found in the literature regarding the ratios of vacancy costs to wages. *Bruckner-Pappa (*2012*)* and *Bermperoglou et al. (*2013*)* use a value of 4.5 percent following *Hagedorn-Manovski (*2008*)*. But others, such as *Christoffel et al. (*2009*)* and *Staehler-Thomas (*2012*)*, consider higher values, around 6-7 percents, while the highest value is used by *Gertler et al. (*2008*)*, almost 9 percent. I calibrate these ratios to 7 percent in both sectors, which is in the middle of the range in the literature.

My calibration implies that the job-finding rates are 22.4 and 17.8 percent in the family and non-family sectors, respectively. This is in line with unemployment duration in the euro area. According to the Eurostat, between 2000 and 2012 about 22.7 percent of unemployed people found a job within one to two months, while about 37.5 percent found a job in less than five months. My values are also similar to those of *Christoffel et al. (*2009*)* and *Staehler-Thomas (*2012*)*. Nevertheless, the values considered for the US are usually higher, 45 percent in *Shimer (*2005*)*, and 83 percent in *Bermperoglou et al. (*2013*)* and in *Bruckner-Pappa (*2012*)*.

As regards the job-filling probabilities, my values are lower than those in the literature: 15.4 and 9.9 percent in the family and non-family sectors, respectively. For the US, *Bermperoglou et al. (*2013*)* and *Bruckner-Pappa (*2012*)* consider $\frac{2}{3}$, while for the euro area, *Christoffel et al. (*2012*)* and *Staehler-Thomas (*2012*)* use 0.7. The reason for this is that in my model, unlike in others, the job-filling probability is linearly and positively related to the vacancy cost.[40] Thus, there is a trade-off in setting both the vacancy cost and the job-filling probability close to values in the literature. I calibrated my model such that the vacancy-posting cost is as similar as possible to other values in the literature, at the cost of accepting lower job-filling probability rates.

Finally, the implied share of total vacancy costs in GDP is 1.7 percent, while the matching efficiencies are 0.186 and 0.159 in the family and non-family sectors, respectively.

[40]See the first-order conditions with respect to the number of posted vacancies in Section 2.

Regarding the dynamic parameters, the relative risk aversion is 1.38 and the external habit in consumption is 0.71, following *Smets-Wouters (*2007*)*. Also, based on *Smets-Wouters (*2007*)*, the inflation weight in the Taylor rule is 2.04 and the sectoral price rigidity is 66 percent.[41] The debt sensitivity parameter in the lump sum tax rule is set to 2 following *Bermperoglou et al. (*2013*)*. Furthermore, based on *Christiano et al. (*2005*)*, all investment adjustment costs are 2.48. As an assumption, all the shock autocorrelation parameters are 0.75.

Notation	Name	Value
σ_C	relative risk aversion	1.38
h	external habit in consumption	0.71
ϕ_F	price rigidity parameter, when share of firms which do not set prices in F is 66 %	56.01
ϕ_{NF}	price rigidity parameter, when share of firms which do not set prices in NF is 66 %	56.01
γ_π	inflation parameter in Taylor rule	2.04
χ_B	debt rule parameter in lump sum tax rule	2
ϕ_{IF}	F physical investment adjustment cost	2.48
ϕ_{INF}	NF physical investment adjustment cost	2.48
ϕ_{IOF}	F organisational investment adjustment cost	2.48
	all autocorrelation parameters	0.75

Table 4: Dynamic parameters

After calibrating the model, it is loglinearised and solved by Dynare 4.4.2.

4 Results

4.1 Baseline results

Four stochastic fiscal austerity shocks are considered, all of them are 1 percent of GDP size: i) a decrease in government consumption, ii) an increase in the rate of value-added tax, iii) an increase in employees' labor income tax rate (personal labor income tax and social security contribution) and iv) an increase in employer social security contribution.

Table 5 shows the unemployment multipliers: i) at peak and ii) cumulatively. A peak multiplier is the largest response after the shock, while the cumulative multipliers are the sum of the multipliers in the first one, two and four years, respectively. All multipliers are presented in percentage point deviations from the steady state. Also, Figure 2 presents stochastic impulse response functions of the consumption tax shock; those of other shocks are shown in Figures 3-5 of the Appendix.

[41] Because my model contains Rotemberg price rigidity, and not Calvo price rigidity, *Lombardo-Vestin (*2007*)*'s approach is adopted for calculating the Rotemberg parameters in line with the Calvo ones.

	Government consumption cut	Value added tax increase	Labor income tax increase (employee)	Labor income tax increase (employer)
Peak	0.52	0.02	0.12	0.07
Cumulative (1 year)	0.71	0.04	0.34	0.19
Cumulative (2 years)	0.67	0.06	0.55	0.31
Cumulative (4 years)	0.48	0.03	0.51	0.29

Table 5: Unemployment fiscal multipliers (in percentage points)

I can conclude that fiscal consolidation raises unemployment. At peak, the highest increase, 0.52 percentage points, is implied by a cut in government consumption. At peak, both labor income tax hikes induce a lower increase in unemployment than a government consumption cut does, 0.12 and 0.07 percentage points, respectively. The hike in value added tax is the least costly in terms of employment; at peak it raises unemployment by only 0.02 percentage points.

Nevertheless, the cumulative multipliers show a somewhat different picture. On the whole, during the four years, the cut in government consumption and the increase in the employees' labor income tax cause the highest and almost the same level of increase in unemployment: 0.48 and 0.51 percentage points, respectively. At the same time, over a shorter time horizon, the government consumption multiplier still exceeds any other multiplier. Again, an increase in the employer social security contribution is less harmful for employment than an increase in the employees' labor income tax. Cumulatively, also, consolidating the budget by increasing the value added tax revenue is least costly in terms of employment.

Regarding the economic driving forces behind my results, the consumption tax rate directly affects the price of consumption, so as demand goes down a higher consumption tax rate implies a decline in consumption. Employment is less affected as investment goes up, which means that total demand (output) does not significantly change. As for the cut in government consumption, even though household consumption and investment increase, total demand (output) considerably declines. In spite of the lower wages, firms, therefore decrease employment owing to a lower demand for labor. At the same time, concerning the labor income tax shocks, the main driving force is related to wage bargaining. The increase in employees' labor income tax implies a decline in worker values, which means being employed becomes less favourable than the outside option (unemployment benefit). The increase in the employer social security contribution rate has a negative effect on the firm values, however. The fact that increasing the employees' labor income tax is more harmful for employment than increasing the employer social security contribution highlights the relatively more important role of worker values. Moreover, the greater the bargaining power of workers, the more truth there is to this claim.

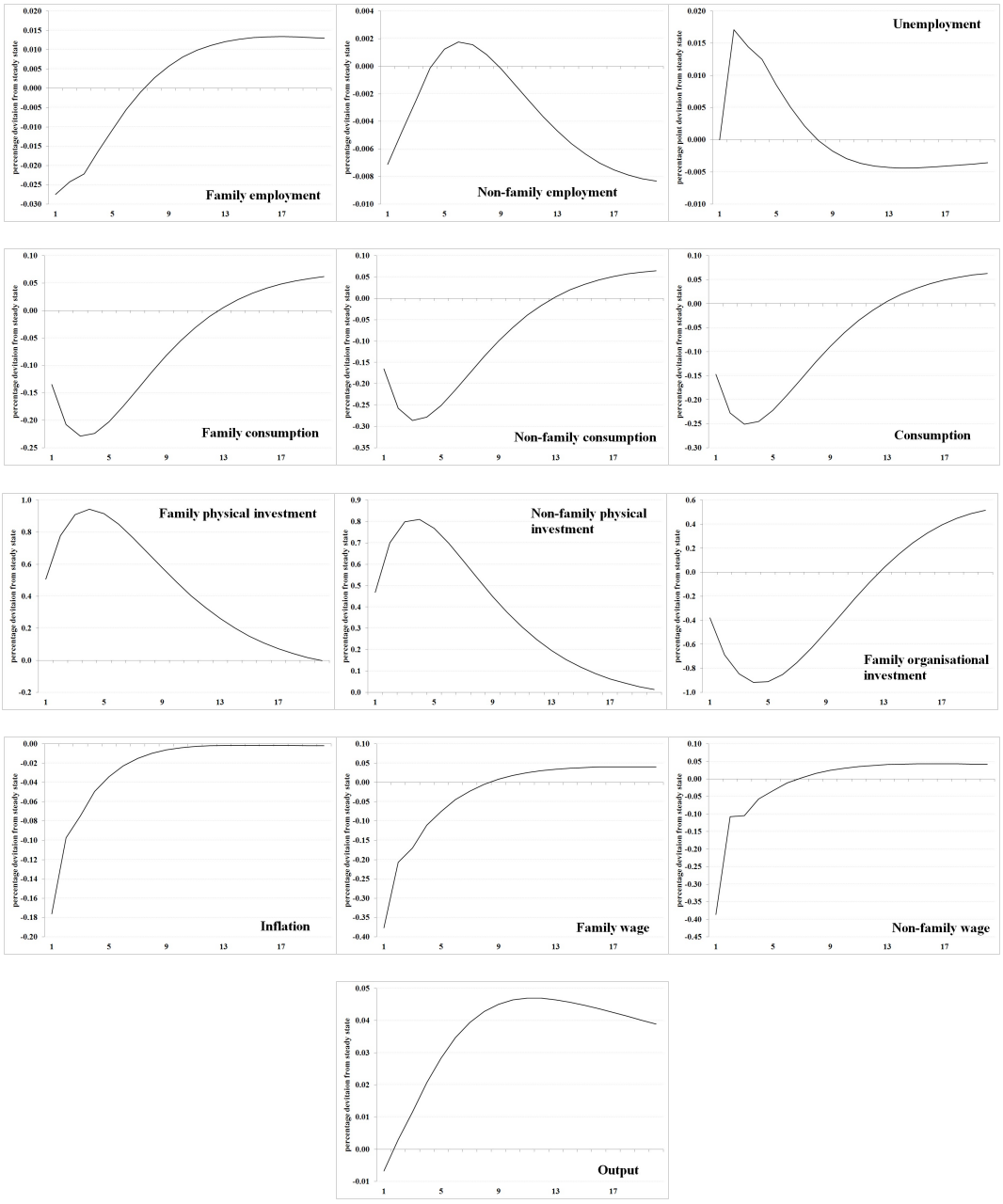

Figure 2: An increase in value added tax revenue equal to 1 percent of GDP

Thus, my results suggest that, if the aim of the government is to consolidate the budget at the lowest price in terms of employment, an increase in value-added tax should be implemented. Moreover, a cut in government consumption usually implies a higher increase in unemployment than do labor income tax hikes, and an increase in employees' labor income tax is more harmful for employment than increasing the employers' social security contribution rate.

With regard to the existing literature, my qualitative results are in line with studies that suggest that tightening fiscal policy on the expenditure side increases unemployment. As regards the size of the unemployment multiplier of government

consumption, it is close to *Monacelli et al. (*2010*)*. Further, my results are consistent with *Ball et al. (*2013*)*, who show that spending-based adjustments have a more pronounced effect on unemployment than tax-based adjustments (only at peak, however). Nonetheless, as they employ a narrative approach, they are unable to compare different tax policies. Thus, another main contribution of this paper is estimating, for the first time, the tax-side unemployment multipliers.

Nevertheless, unemployment is clearly not the sole concern of the government. Regarding output, all policies, apart from the value-added tax policy, induce a decline in output. The largest decline occurs after a cut in government consumption; output goes down on impact by more than 0.4 percent. Also, not only the reaction of GDP, but also that of household consumption is important. The only policy that raises household consumption is a cut in government consumption (household consumption goes up by more than 0.9 percent at peak). At the same time, household consumption goes down considerably when the rate of value-added tax is increased (at peak by 0.25 percent). Hence, there are trade-offs a policymaker must consider.

Combining policies might be a way to manage these trade-offs. Given the debate on shifting the focus of taxation from labor income toward value-added taxes, I have had a look at two combined policies, namely, an increase of 1 percent of GDP in revenue from value-added tax, and the same size of decrease in the employees' or employers' labor income tax revenue, keeping the budget deficit unchanged.[42] These combined policies induce a 0.1 and a 0.05 percentage points decline in unemployment, respectively at peak. At the same time, household consumption goes down somewhat less than after an increase in value-added tax, and output goes up compared to a decline following the hikes in labor income tax.

4.2 The role of sectoral heterogeneity

Sectoral heterogeneity on the firm side - besides labor force participation and short- and long-term unemployment suggested by *Bermperoglou et al. (*2013*)* - might be another way to explain the gap between theoretical and empirical multipliers reported but unexplained by *Monacelli et al. (*2010*)*. In this section, three alternative scenarios are compared to the baseline scenario: i) the only sector is the family sector, ii) the only sector is the non-family sector, iii) and a two-sectoral framework without family capital; the model closest to the literature is the one with only a non-family sector.

First, the volatility of unemployment is significantly lower in a one-sector model, and also without the inclusion of organisational capital compared with the baseline two-sector model.[43] This is related to fact that, in a two-sector model, the presence of the two sectors creates the possibility of sectoral movements due to changes in relative sectoral prices and wages.

[42]Impulse responses are presented in Figures 6-7 of the Appendix.

[43]The volatility of unemployment is 2.9 if only family firms are considered, 3.3 if only non-family firms are considered, and 4.3 if organisational capital is not considered, compared to the baseline value of 8.7.

	BASELINE	Only family firms	Only non-family firms	Both, but no organisational capital
	Peak			
Government consumption cut	0.52	0.15	0.12	0.25
Value added tax increase	0.02	0.03	0.01	0.02
Labor income tax increase (employee)	0.12	0.03	0.01	0.04
Labor income tax increase (employer)	0.07	0.02	0.01	0.02
	Cumulative (1 year)			
Government consumption cut	0.71	0.22	0.19	0.36
Value added tax increase	0.04	0.09	0.02	0.06
Labor income tax increase (employee)	0.34	0.08	0.04	0.12
Labor income tax increase (employer)	0.19	0.05	0.02	0.07
	Cumulative (2 years)			
Government consumption cut	0.67	0.25	0.20	0.37
Value added tax increase	0.06	0.16	0.03	0.09
Labor income tax increase (employee)	0.55	0.15	0.07	0.21
Labor income tax increase (employer)	0.31	0.02	0.04	0.12
	Cumulative (4 years)			
Government consumption cut	0.48	0.20	0.18	0.31
Value added tax increase	0.03	0.17	0.03	0.08
Labor income tax increase (employee)	0.51	0.19	0.08	0.23
Labor income tax increase (employer)	0.29	0.11	0.05	0.13

Table 6: Unemployment fiscal multipliers and sectoral heterogeneity (in percentage points)

Second, sectoral heterogeneity seems to play a crucial role (Table 6)[44]; unemployment multipliers are very different with and without it. When homogeneous firms are considered, multipliers of labor income tax policies and government consumption multipliers are usually biased downwards, while the consumption tax multipliers are often biased upwards. Comparing the baseline multipliers to those of the alternative scnearios, one can conclude that about half of the difference is due to the number of sectors, and the other half is related to the inclusion of intangible capital.

4.3 Robustness with respect to parameter values

Tables 8 and 9 of the Appendix show multipliers with different parameter values. We can conclude that the sign of the multipliers is always robust, while their magnitude is also highly robust. The main exception is the degree of price rigidity, which significantly affects the magnitude of the government consumption and the value-added tax multipliers. In some cases, multipliers are also sensitive to the unemployment benefit replacement ratio and the dismissal rate.

There is no evidence in the literature as to whether family or non-family firms set prices more often. At the same time, *Goldberg-Hellerstein (*2011*)* show that small firms set prices more often than large firms, and *Bach (*2010*)* claims that family firms are usually smaller than non-family firms. I consider therefore an alternative scenario in which family firms set prices more often than do non-family firms, while in the baseline scenario the sectoral price rigidities were equal. When 70 percent of family firms do not set prices compared to the baseline 66 percent, the government consumption multiplier, at peak, goes up to 0.67 percentage points (other multipliers do not change significantly). Concerning cumulative multipliers, both the government consumption multiplier and the consumption tax multiplier increase considerably. Still, the main policy conclusions remain the same. The importance of the degree of price rigidity for unemployment fiscal multipliers was also highlighted by *Bruckner-Pappa (*2012*)*, stressing the role of the demand effect.[45]

Regarding the unemployment benefit replacement rate, there is a wide range of values in the literature, which was summarised in Section 3. As already pointed out by *Gertler et al. (*2008*)*, this ratio is crucial for the impulse responses of a model with search and matching frictions. When decreasing this rate, at peak, unemployment increases less after a cut in government consumption. This might be because a lower replacement rate means a lower outside option, so that being unemployed becomes relatively less attractive. Cumulatively, not only the government consumption multiplier, but also the employees' labor income tax multipliers are affected, albeit to a lesser extent. Similar findings hold for the dismissal rates.

[44]See also Figure 8 of the Appendix.

[45]Generally, *Woodford (*2011*)* points out that sticky prices imply a larger output government expenditure multiplier.

5 Conclusion and discussion

The aim of this paper was to estimate unemployment multipliers of expenditure and revenue-side fiscal austerity policies. My research contributes to the body of knowledge as there is a debate on both the sign and the size of the unemployment multipliers of government expenditure items. Moreover to the best of my knowledge, this is the first paper to estimate unemployment multipliers of tax policies.

My model was based on a standard, closed-economy DSGE framework with sticky prices and search and matching frictions, and as a novelty, on the firm side there was a distinction between family and non-family firms. Sectoral heterogeneity has not yet been taken into account in the unemployment fiscal multiplier literature, although firms are obviously not homogeneous. Family firms employ a notable share of the labor force in Europe, and the differently managed family and non-family firms behave very differently in the labor market. The model was calibrated to match data of European countries with a large percentage of family firms in employment, while the characteristics of family firms were based on empirical, micro-level evidence documented in the corporate finance literature.

My model predicts that fiscal austerity raises unemployment. At peak, the highest increase in unemployment is implied by a cut in government consumption. Nevertheless, a hike in employees' labor income tax, cumulatively, implies the same size of increase in unemployment as does the government consumption cut. A higher employer social security contribution is less costly in terms employment than an increase of the same size in employees' labor income tax, however. Both at peak and cumulatively, unemployment reacts least when the budget is consolidated by increasing the rate of value-added tax. Nonetheless, a policymaker will need to deal with trade-offs, as the increase in value-added tax results in the highest decline in consumption.

Sectoral heterogeneity seems to play a crucial role: unemployment fiscal multipliers are very different with and without it. When homogeneous firms are considered, multipliers of labor income tax policies and government consumption multipliers are usually biased downwards, while the consumption tax multipliers are often biased upwards. Ignoring sectoral heterogeneity might lead, then, to incorrect policy conclusions, although, according to my results budget consolidation is always the least harmful for employment when done through increasing consumption tax revenue.

Regarding the existing literature, my results are qualitatively in line with those who suggest that tightening fiscal policy on the expenditure side increases unemployment. As regards the size of the unemployment multiplier of government consumption, it is close to *Monacelli et al. (*2010*)*. Furthermore, my results are consistent with *Ball et al. (*2013*)*, who show that spending-based adjustments have a more pronounced effect on unemployment than tax-based adjustments (only at peak, though). Because they use a narrative approach, however, they are unable to compare different tax policies. Thus, another main contribution made by this paper is estimating, for the first time, the tax-side unemployment multipliers. Finally, sectoral heterogeneity on the firm side - besides labor force participation and short- and

long-term unemployment suggested by *Bermperoglou et al. (*2013*)* - might be another explanation of the gap between theoretical and empirical multipliers reported but unexplained by *Monacelli et al. (*2010*).*

Does this mean that the government should consolidate the budget by increasing the role of consumption taxation? This depends on the goals of the government, and how each goal is weighted. Clearly, increasing the rate of value-added tax is least costly in terms of employment, at any time-horizon considered. However, there are trade-offs. In particular, household consumption declines considerably after this policy is implemented, and, actually, this policy is the most harmful for household consumption. Should the government care more about the number of unemployed or about the amount of consumption of society as a whole? This raises further questions. First, does inequality increase more when more people are unemployed, or does inequality increase more when household consumption declines more? Inequality is related to the progressivity of the tax system, which usually decreases inequality, and while labor income taxation is often progressive, consumption taxation is always regressive. A drawback of my modeling framework is that - due to the representative agent assumption - no inequality measure can be defined, leaving me unable to answer these important questions. Second, do we think that, as time goes by, it is more difficult to leave unemployment? If so, then the less time that passes since losing a job, the higher the probability of finding another one. In this case, a decline in consumption might be less harmful than an increase in unemployment from a longer-term point of view.

Similarly, there are some other features that were beyond the scope of this paper. First, although firms were not homogeneous in my model, workers were. Now, unemployment is due to search and matching frictions only, but if skill heterogeneity was present, a skill mismatch between workers and firms would be an additional reason for unemployment. The inclusion of this channel would enlarge the role and importance of education policies, too. Second, although social security contributions were deducted from gross wages, a detailed modeling of the social security system was not the aim of this paper. This would require overlapping generations in the framework, i.e. a distinction between young and old households. Such an extension might be relevant, however, when studying the differences between the impacts of employees' and employers' social security contribution hikes. Finally, a significant part of output and employment is 'in the shadow' (*Schneider et al.,* 2010 and *Schneider,* 2012), which cannot be directly influenced by the government. If family firms tend to be more in the shadow (do they?), then they might be relatively less affected by any government policy. This is another consideration in the design of prudent governmental policies.

As I pointed out earlier, sectoral heterogeneity on the firm side has not been considered before in the unemployment fiscal multiplier literature. Did we find evidence of its importance in this paper? I think we did, and we can conclude that sectoral heterogeneity, and a distinction between family and non-family firms, in particular, has a crucial role concerning the magnitude of unemployment fiscal multipliers. These multipliers are very different with and without sectoral heterogeneity. Multipliers of labor income tax policies are usually biased downwards, while the

consumption tax multipliers are often biased upwards with a representative firm. Ignoring sectoral heterogeneity might lead, then, to incorrect policy conclusions. Here we are not concerned with determining the "best" fiscal austerity policy for employment, which, according to my results, is always an increase in consumption tax, but rather, with regard to the relative employment cost of the "second-best" policies. The latter are clearly more harmful for employment, although they might have other advantages (e.g. a smaller decline or an increase in household consumption). And, as we discussed above, even though an increase in value-added tax is least harmful for employment, a government might want to adopt a different policy if it has, at least in part, different priorities. In such cases, it is very important to know the precise cost of such a policy.

Concerning the role of family capital, which is one side of the sectoral heterogeneity story, we can conclude that, comparing our baseline multipliers to alternative multipliers, about half of the difference between the one- and two-sectoral multipliers was due to the sectoral heterogeneity itself (ie. the number of sectors). The other half was attributable, however, to the inclusion of intangible capital in the family sector, nonetheless, our main conclusions remain the same. The results should be treated with a degree of caution, however, because dynastic management is a latent variable that is difficult to measure.

6 Appendix

6.1 Baseline stochastic impulse response functions

Figues 3-5 show baseline stochastic impulse response functions of the following fiscal consolidation policies (all 1 percent of GDP in size): i) cut in government consumption, ii) increase in the employees' labor income tax (personal labor income tax and social security contribution) and iii) increase in the employer social security contribution rate.

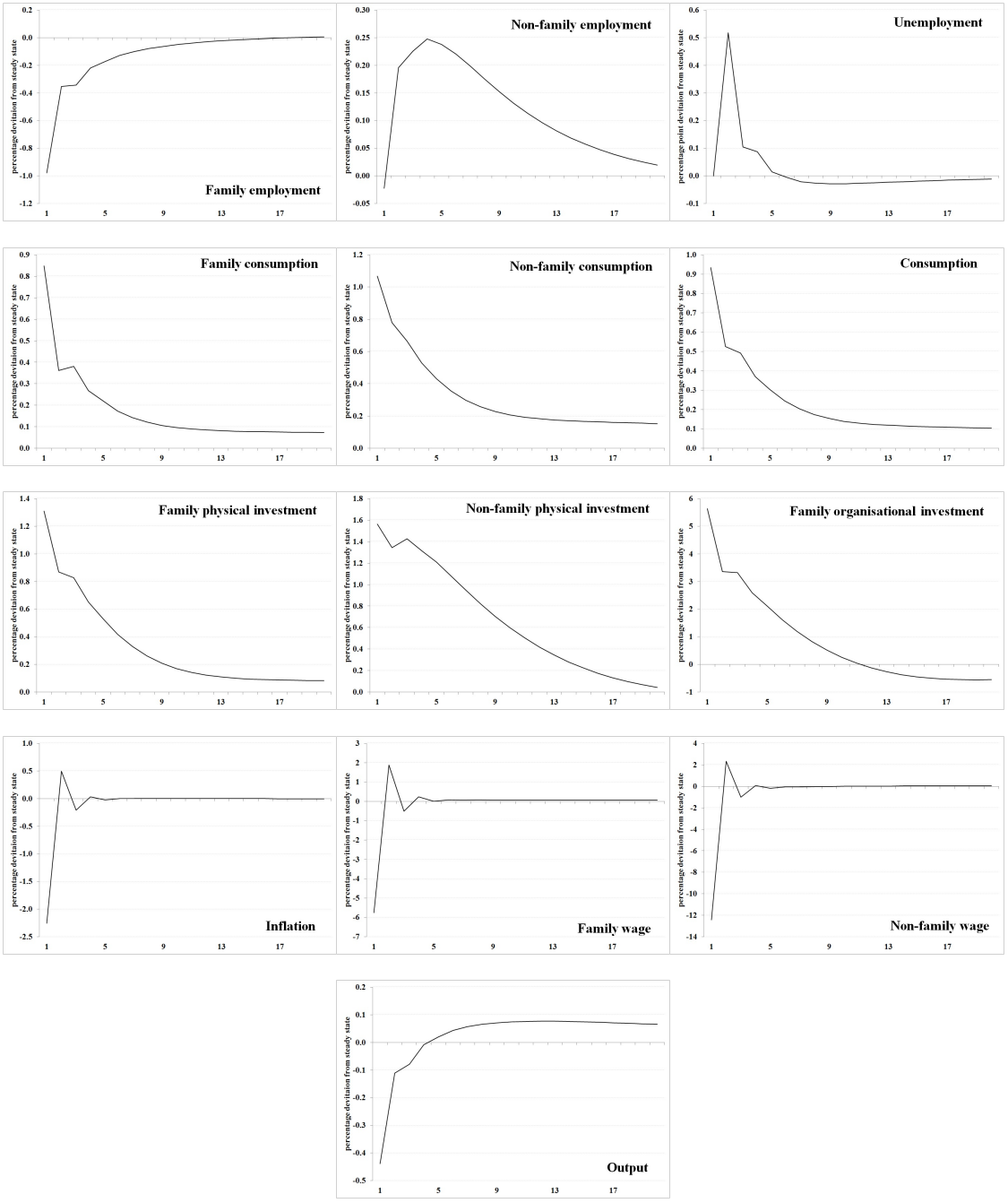

Figure 3: A cut in government consumption equal to 1 percent of GDP

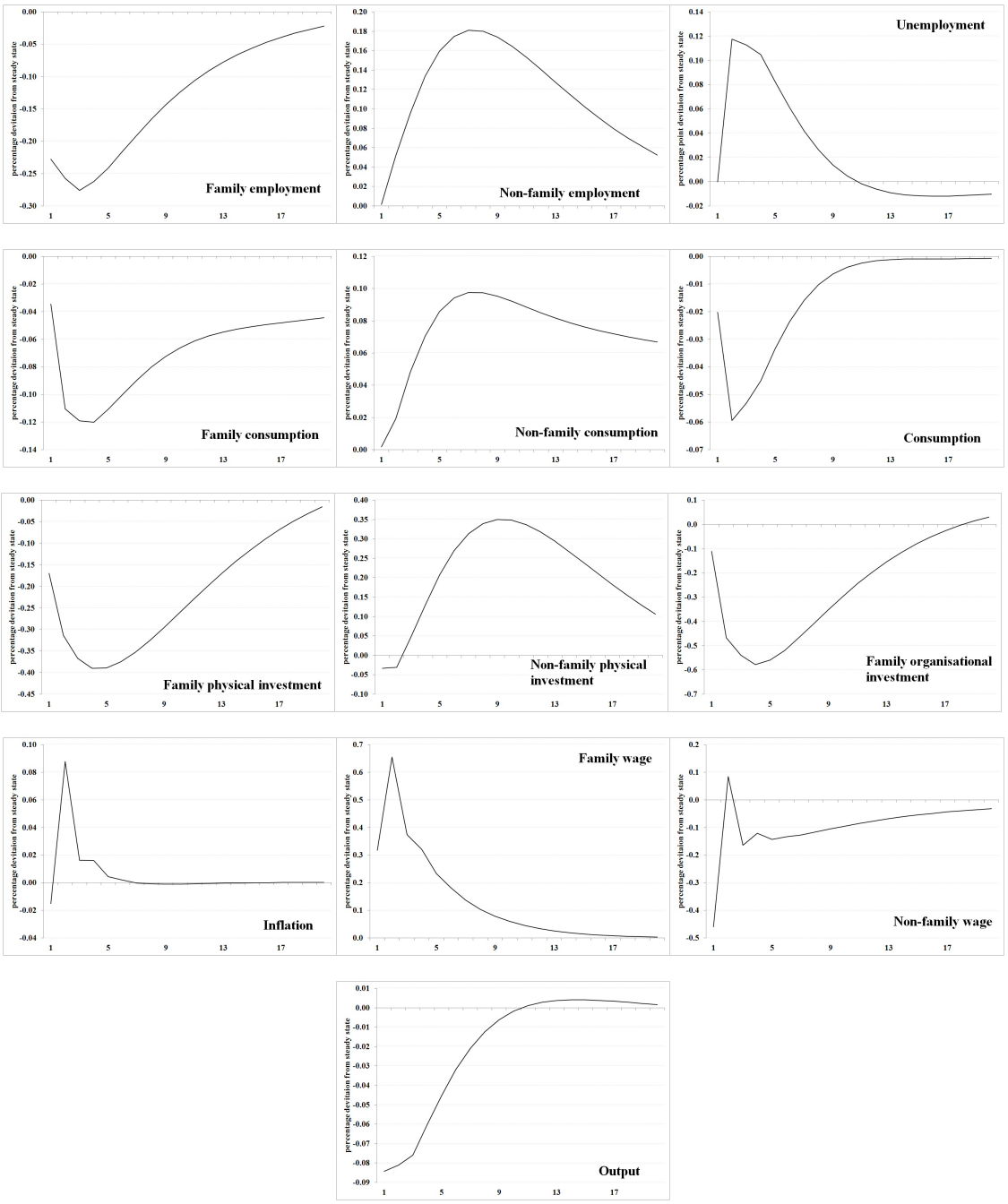

Figure 4: An increase in employees' labor income tax (personal labor income tax and social security contribution) revenue equal to 1 percent of GDP

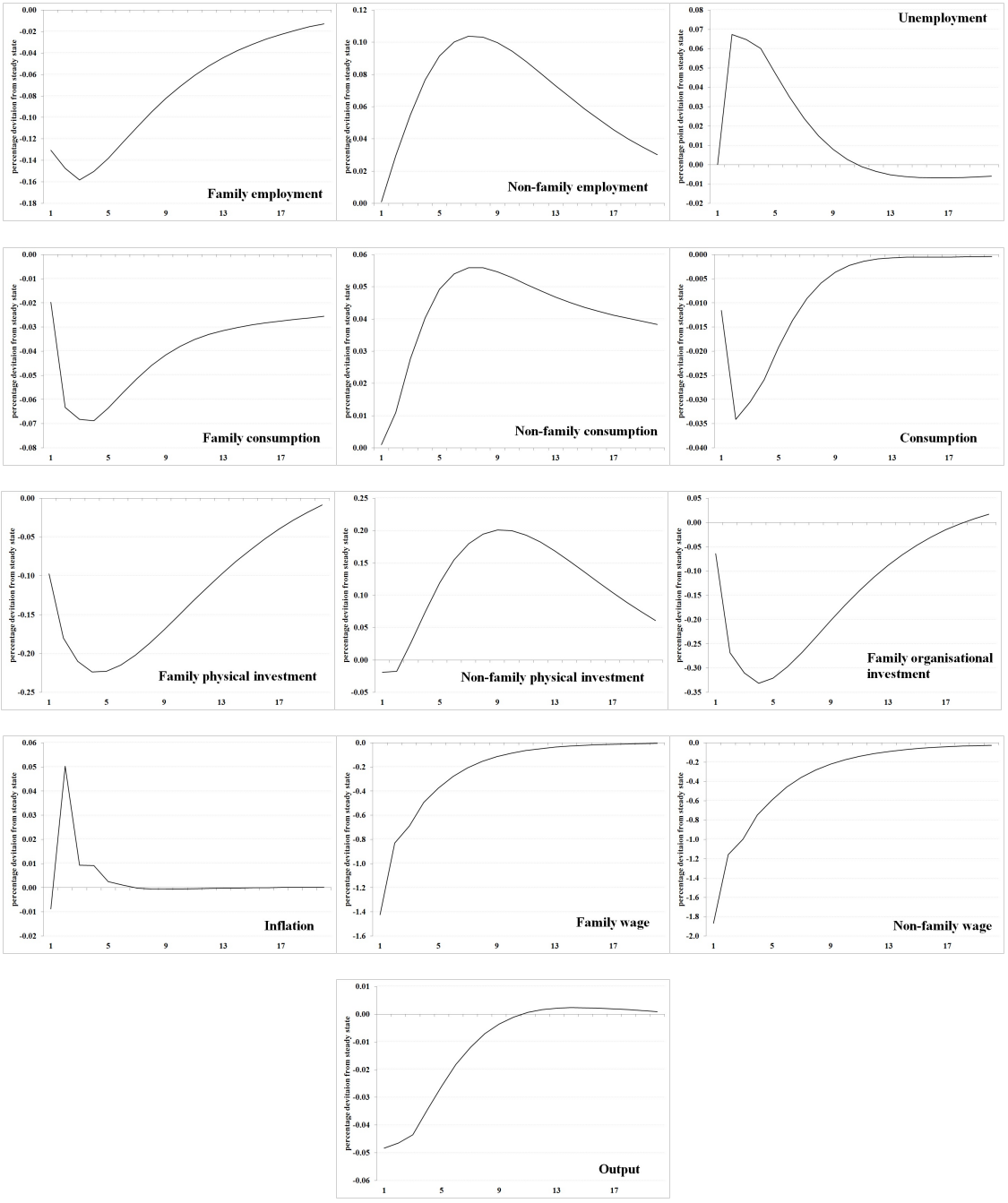

Figure 5: An increase in employer social security contribution revenue equal to 1 percent of GDP

Figures 6-7 present stochastic impulse response functions of tax shifts from consumtpion to labor income taxation (1-1 percents of GDP), while keeping the government deficit at its steadystate level.

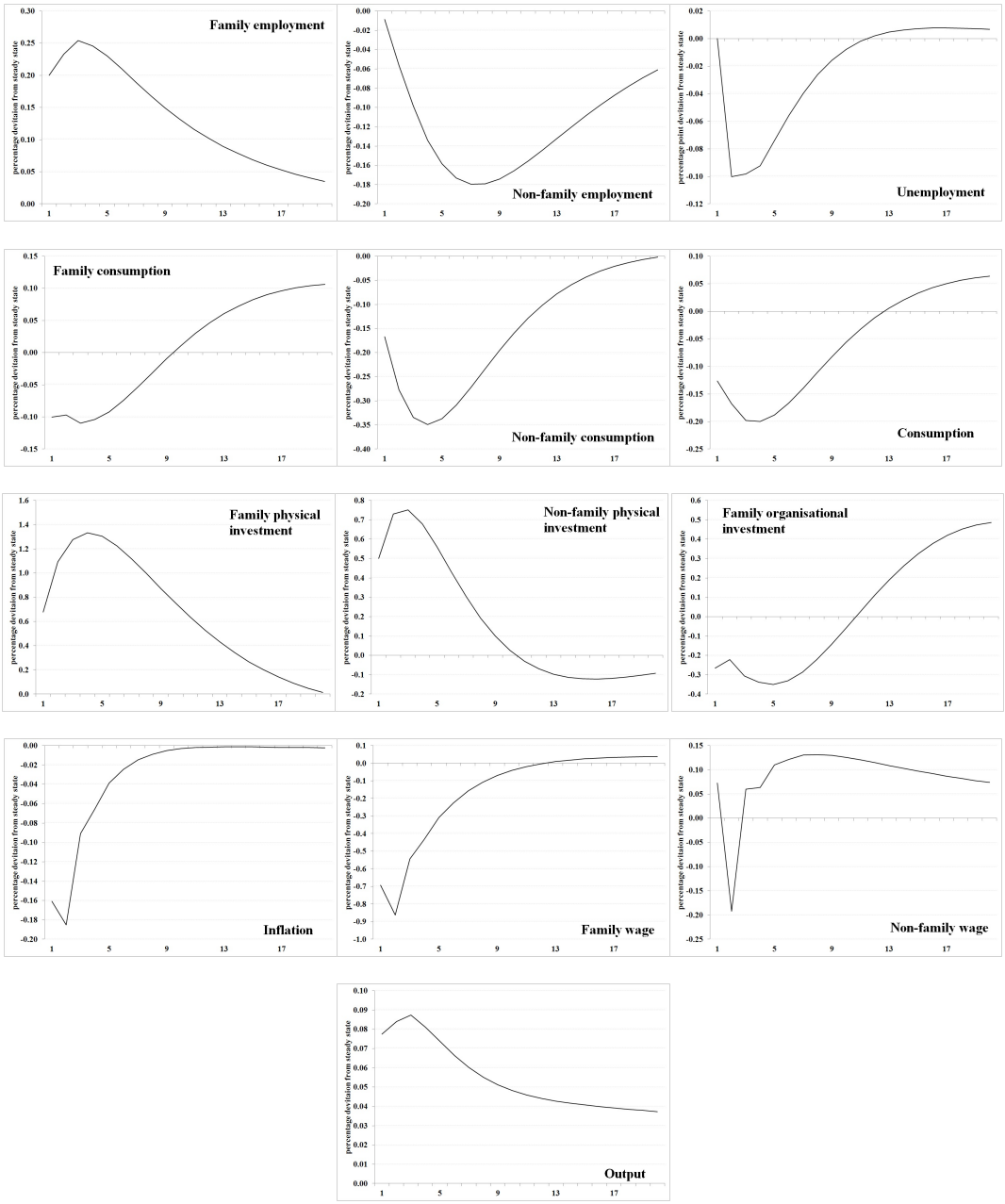

Figure 6: Tax shift (a 1-1 percent of GDP decrease in employees' labor income tax revenue and increase in value added tax revenue)

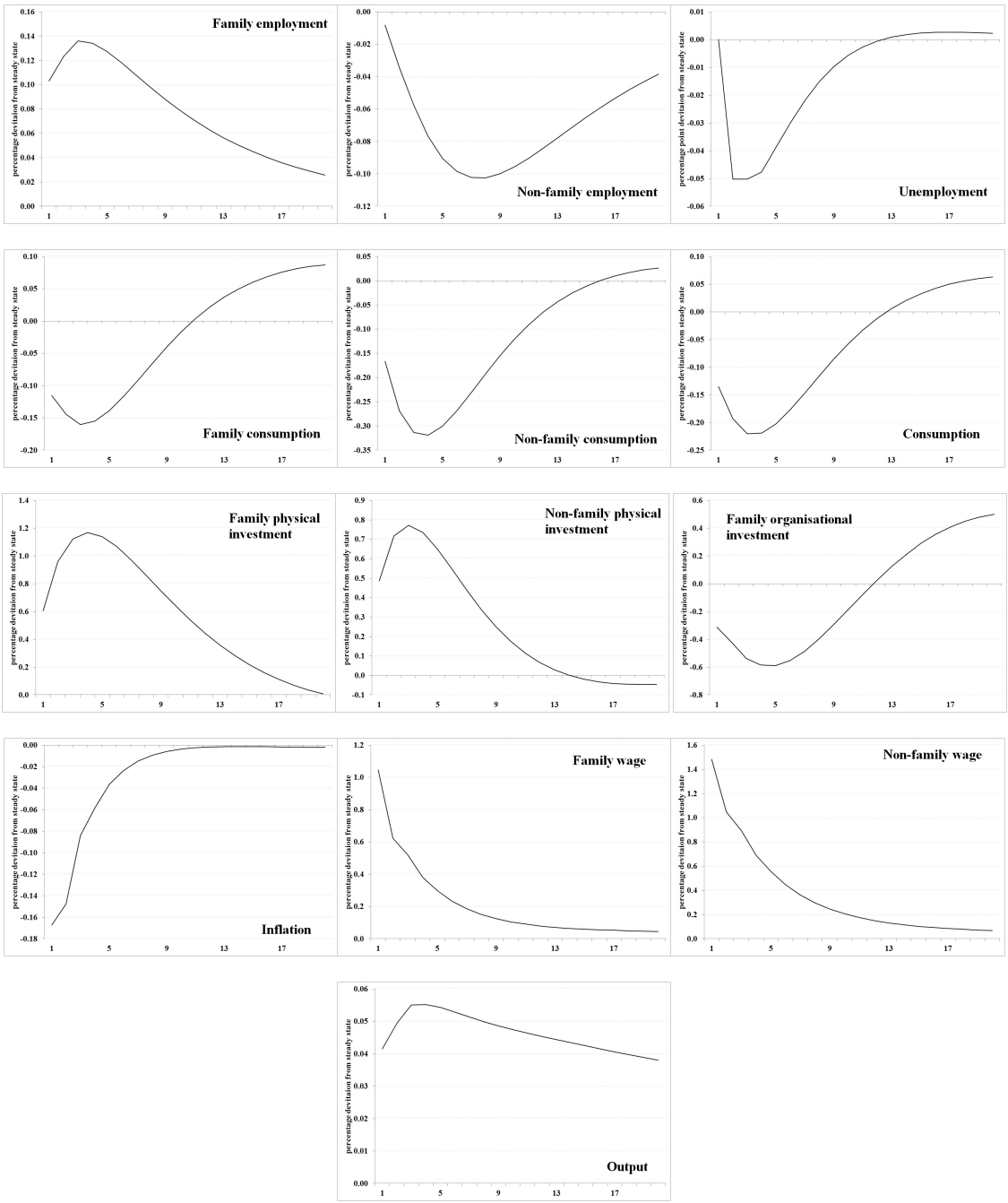

Figure 7: Tax shift (a 1-1 percent of GDP decrease in employer social security contribution revenue and increase in value added tax revenue)

6.2 Role of sectoral heterogeneity and robustness of parameter values

Figure 8 shows the effects of sectoral heterogeneity on stochastic impulse response functions. The solid line is the baseline model. The dotted line is a one-sector model assuming that all firms are family firms, while the line with round markers is another one-sector model where all firms are non-family firms. The line with squared markers is a two-sector model without organisational capital in the family sector.[46] Tables 7 and 8 present the sensitivity of unemployment fiscal multipliers with respect to i) the unemployment benefit replacement rate, ii) the bargaining power of workers in the non-family sector, iii) the dismissal rate of workers in the family sector, iv) family productivity level, v) effectiveness of family organisational investment and vi) the level of price rigidity in the family sector.

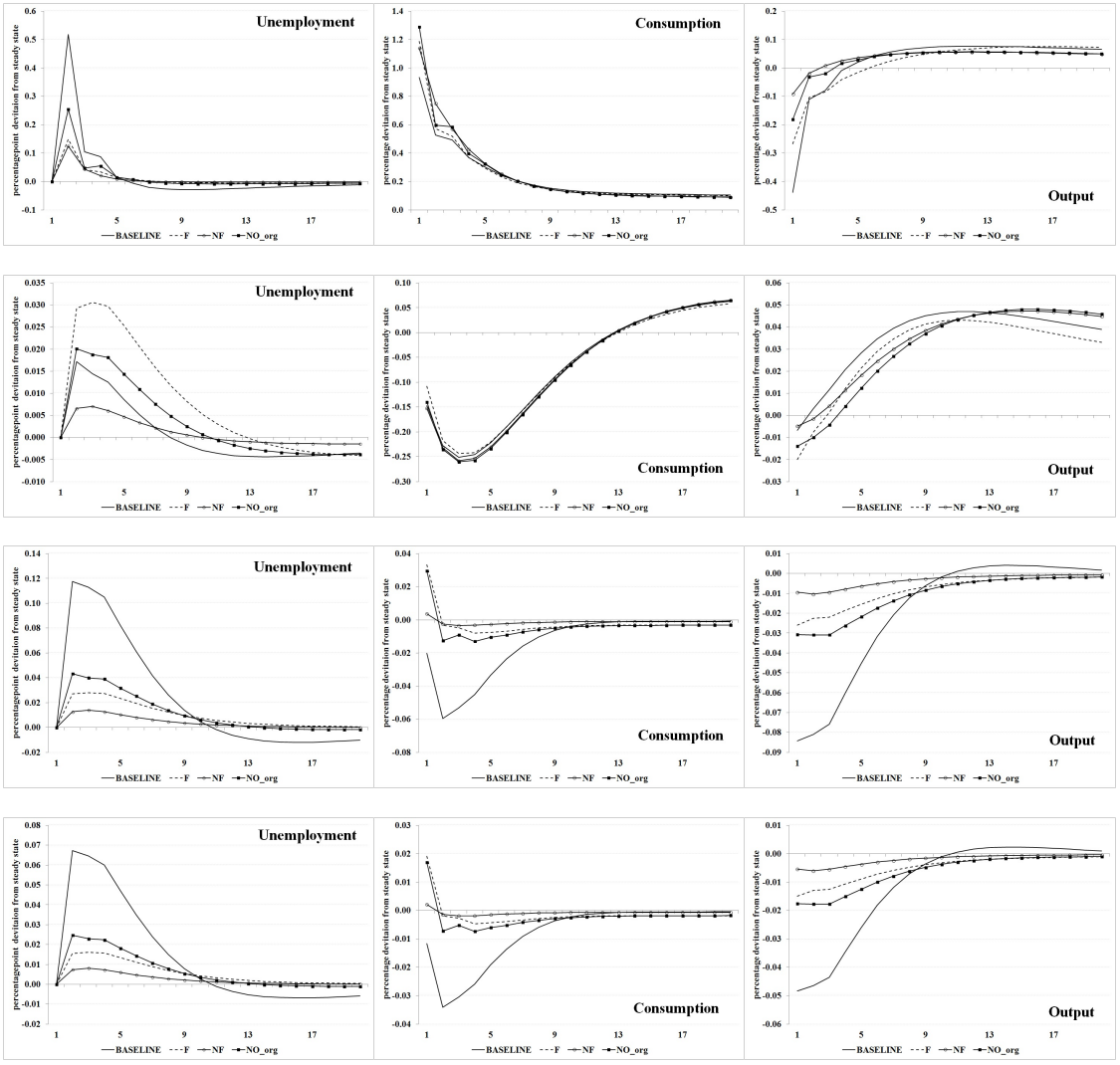

Figure 8: First column: a cut in government consumption. Second column: an increase in value added tax revenue. Third column: an increase in employees' labor income tax. Fourth column: an increase in the employer social security contribution. All shocks correspond to 1 percent of GDP.

[46]Impulse responses of other variables are available upon request.

	Peak			
	BASELINE	b=0.25	$\lambda_{NF}=\sigma_{NF}=0.75$	$1-\rho_F=0.0576$
Government consumption cut	0.52	0.46	0.48	0.47
Value added tax increase	0.02	0.02	0.02	0.02
Labor income tax increase (employee)	0.12	0.10	0.10	0.10
Labor income tax increase (employer)	0.07	0.06	0.06	0.06
		$A_F=0.99$	$\theta=0.975$	$\phi_F=75\%$
Government consumption cut		0.57	0.53	0.67
Value added tax increase		0.02	0.02	0.03
Labor income tax increase (employee)		0.13	0.12	0.12
Labor income tax increase (employer)		0.08	0.07	0.07
	Cumulative (1 year)			
	BASELINE	b=0.25	$\lambda_{NF}=\sigma_{NF}=0.75$	$1-\rho_F=0.0576$
Government consumption cut	0.71	0.63	0.65	0.64
Value added tax increase	0.04	0.04	0.05	0.05
Labor income tax increase (employee)	0.34	0.27	0.29	0.27
Labor income tax increase (employer)	0.19	0.16	0.17	0.16
		$A_F=0.99$	$\theta=0.975$	$\phi_F=70\%$
Government consumption cut		0.78	0.73	0.88
Value added tax increase		0.04	0.04	0.07
Labor income tax increase (employee)		0.39	0.34	0.33
Labor income tax increase (employer)		0.22	0.20	0.19

Table 7: Unemployment fiscal multipliers - robustness with respect to parameter values (in percentage points)

	Cumulative (2 years)			
	BASELINE	b=0.25	$\lambda_{NF}=\sigma_{NF}=0.75$	$1-\rho_F=0.0576$
Government consumption cut	0.67	0.61	0.62	0.62
Value added tax increase	0.06	0.06	0.07	0.07
Labor income tax increase (employee)	0.55	0.45	0.48	0.45
Labor income tax increase (employer)	0.31	0.26	0.28	0.26
		$A_F=0.99$	$\theta=0.975$	$\phi_F=75\%$
Government consumption cut		0.72	0.68	0.83
Value added tax increase		0.05	0.06	0.09
Labor income tax increase (employee)		0.62	0.56	0.53
Labor income tax increase (employer)		0.36	0.32	0.31
	Cumulative (4 years)			
	BASELINE	b=0.25	$\lambda_{NF}=\sigma_{NF}=0.75$	$1-\rho_F=0.0576$
Government consumption cut	0.48	0.45	0.46	0.46
Value added tax increase	0.03	0.03	0.05	0.04
Labor income tax increase (employee)	0.51	0.43	0.47	0.44
Labor income tax increase (employer)	0.29	0.25	0.27	0.25
		$A_F=0.99$	$\theta=0.975$	$\phi_F=70\%$
Government consumption cut		0.50	0.48	0.61
Value added tax increase		0.02	0.03	0.06
Labor income tax increase (employee)		0.57	0.53	0.50
Labor income tax increase (employer)		0.33	0.30	0.29

Table 8: Unemployment fiscal multipliers - robustness with respect to parameter values (in percentage points) cont.

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