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Modelling a Job Guarantee for Germany using a Job Search Model

Master Thesis

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Abstract

This thesis approaches the discussion surrounding a Job Guarantee by applying a Job Search Model. Hereby, a Job Guarantee employment is being modelled with a different wage, separation and job offer arrival rate as compared to regular employment. The model is then solved and parameterized in order to derive a wage above which agents choose the Job Guarantee over unemployment. Next, non-monetary benefits from work are taken into account. The extension of a one-sided Job Search model by the option of state employment is a novelty in the literature. This thesis further delivers a broad overview of the concept of a Job Guarantee with a focus on the German case.

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List of symbols and abbreviations

NAIRU	non-accelerating inflation rate of unemployment
NAIBER	non-accelerating inflation buffer stock employment ratio
ELR	employer of last resort
PSE	public service employment
ABM	Arbeitsbeschaffungsmaßnahme (job creation measure)
e.g.	for example
i.e.	id est
u	unemployment
e	employment
JG	Job Guarantee
V	utility
r	interest rate
β	discount factor
q	separation rate from regular employment
x	separation rate from Job Guarantee employment
η	utility from working

1 Introduction

This thesis conceptualizes and assesses a Job Guarantee for Germany. The idea behind a Job Guarantee is to overcome involuntary unemployment by creating an infinitely elastic demand for labor by the state (Minsky and Kaufman, 2008). Its goal is to enable social inclusion through a job. Whereas people "unlearn by not doing" (Sen, 1997, p. 161) in times of unemployment, a Job Guarantee maintains the human capital. With a Job Guarantee, the state offers employment to anyone willing to work at a certain wage. By this, a lower limit to the price of labor is being set (Kaboub, 2007). As high unemployment rates and persistent long-term unemployment, especially during the Covid-19 pandemic, are the status quo in Europe, a Job Guarantee is being proposed.[1] The policy measure is discussed in the literature where proponents emphasize the inequality-reducing effect as well as the fact that personal and social costs from unemployment are being reduced.[2] Opponents criticize the high costs of such a program, the interference in the labor market equilibrium as well as highlighting the inflation-stabilizing role of unemployment.[3]

The focus of this work lays on the case for Germany, for which policy experiences are being discussed. Next, a modified Job Search Model is used which incorporates the option for unemployed agents to choose the Job Guarantee. The model defines different utility functions for each state of the labor market. Thereafter, these are compared in order to come up with a wage level above which unemployed agents would choose the Job Guarantee. The derived wage in the Job Guarantee employment lays at around 96.035, as compared to a wage of 100 currency units which is assumed for the private sector. The similarity between the wages in the two sectors can be explained by the fact that the theoretical model broke the Job Guarantee down to an employment relation with different wage, job offer arrival and separation rates. By non-monetary benefits, positive effects from work are subsumed. This shows a reduction in the derived reservation wage.

Section 2 discusses the role of the unemployment rate in economic theory. Next, the 'invisible' costs of unemployment are outlined. Given the large amount of literature approaching this topic and finding tremendous social and economic costs, this chapter focuses on the downside of unemployment. The following section explains the concept of a Job Guarantee, highlighting its benefits and potential problems. Reviewing results in the literature, a focus especially lays on findings concerning price stability. Subsequently, the case for Germany is discussed in more detail. As a Job Guarantee strongly affects the flow of workers and unemployed persons in the economy, the upcoming section clarifies this. The core of this work lays in section 5,

[1] see for example Wray et al. (2018), Tcherneva (2020b), Minsky and Kaufman (2008), and Mitchell (1998). Section 2 presents some unemployment numbers.

[2] see for example Mitchell (1998), Murray and Forstater (2012), Tcherneva (2020b), Wisman (2010), and Wray et al. (2018)

[3] see for example Aspromourgos (2000) for the high costs, Ramsay (2002a) for the inflationary aspect, and orthodox economic textbooks such as Mankiw (2014) arguing in favor of friction-free markets

where a modified Job Search Model is presented and a wage level above which agents accept a Job Guarantee offer is derived. Overall, this work approaches the Job Guarantee topic from a theoretical view, revealing how a Job Guarantee affects the agents' economically efficient decision.

2 Unemployment throughout the economic discipline

As it is central to the debate of a Job Guarantee, the inflation-stabilizing effect of unemployment is considered first. In an economy where all workers would be able to find a job, it is being argued that inflation would raise without restraint, as workers would continuously ask for higher wages (Wisman, 2010). The trade-off between employment and price stability is central in classical economic theory. This section delivers an overview of the theory and emphasizes the role that the unemployment rate plays in the discussion.

Phillips (1958) detected a negative relationship between unemployment and inflation rate for the United Kingdom, which is labelled the Phillips curve. Figure 1 shows the replication of the Phillips curve for the USA (Samuelson and Solow, 1960). The estimation is based on American data from 1935-1960, and shows possible inflation-unemployment combinations for economic policy. Two points are selected: one at which unemployment is around 3% and a price rise of 4.5% and a second one at price stability, requiring roughly 5% unemployment.

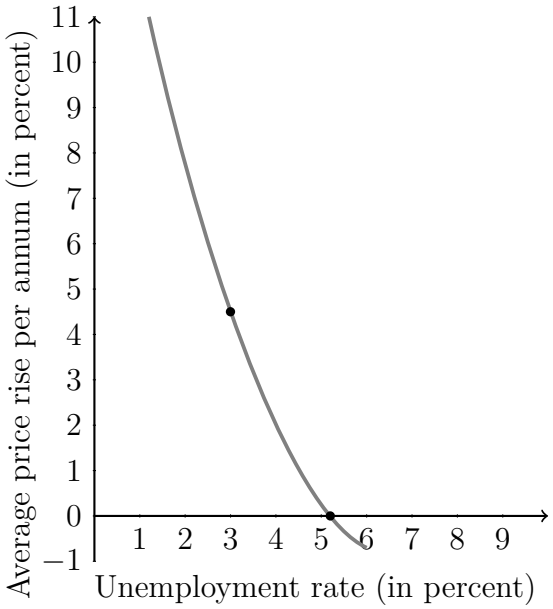

Figure 1: The-Samuelson-Solow-Modified-Phillips-Curve

Unemployment-price rise combinations based on US data. Reproduced from Samuelson and Solow (1960).

Although the relationship vanished in the 1970s, a correlation between unemployment and the *change* in inflation was still being observed (Blanchard, Amighini, et al., 2010). The rela-

tionship finally disappeared, as people adjusted their inflation expectations knowing that they were underestimating future inflation rates, which was postulated out by Milton Friedman and Edmund Phelps (Friedman, 1968). Although the relationship does no longer hold, the notion of a *natural rate of unemployment* has widely been accepted among economists (Blanchard, Amighini, et al., 2010).

This *natural rate of unemployment* equals the level at which inflation remains constant. Following this logic, the correct term would be the *non-increasing inflation rate of unemployment*, still in most textbooks the term *non-accelerating inflation rate of unemployment* (short: NAIRU) is used (Blanchard, Amighini, et al., 2010). In line with the theory, economies have a natural rate of unemployment at which inflation is stable. Clearly, a variety of variables affects this rate, and therefore, economies with different labor market characteristics have different *non-accelerating inflation rates of unemployment*. Using the OECD Economic Outlook database, Blanchard, Amighini, et al. (2010, Table 9.1) have derived the NAIRU for Germany over several periods: from 1991 to 2008 they found a natural rate of unemployment of 8.6%.

In many schools of thought, the unemployment rate therefore plays a vital functional role. In others, its function is being questioned due to the high economic and non-economic costs of unemployment. In Keynesian economics, full employment could be achieved if aggregate demand was simply high enough (Keynes, 2018). Thus, economists in the 1960s in the USA tried to figure out how to stimulate demand most effectively. This era ended in the 1970s when *stagflation* was predominant. High inflation and unemployment rates at the same time led to criticism of the demand-oriented policy. The natural rate of unemployment, as introduced above, entered the debate and yielded the conclusion that a certain *natural* unemployment rate has to be accepted and can not be mitigated by increasing demand. The Ricardian equivalence states that tax cuts or increased government spending will not stimulate demand as consumers know about the caused government debts and anticipate that taxes have to be raised in the future. Economists as a result concluded that in order to reduce unemployment, the incentive to work had to be increased, concretely by cutting social benefits (Wisman, 2010).

Efficiency wages offer another explanation for unemployment: the labor market is at disequilibrium since firms pay higher wages than the equilibrium wage. They do so because they want to prevent the workers from shirking at work. Due to this higher wage, involuntary unemployment arises. The more unemployed people there are in the labor force, the smaller is the markup firms have to pay, in order to prevent workers from shirking. In turn, higher unemployment makes the firm gain higher profits (Wisman, 2010). Figure 2 displays this labor market disequilibrium. The higher real wages which are paid create an excess supply of labor. This results in unemployment, displayed as the difference in quantity of labor supplied and demanded. The theory was first developed by Shapiro and Stiglitz (1984).

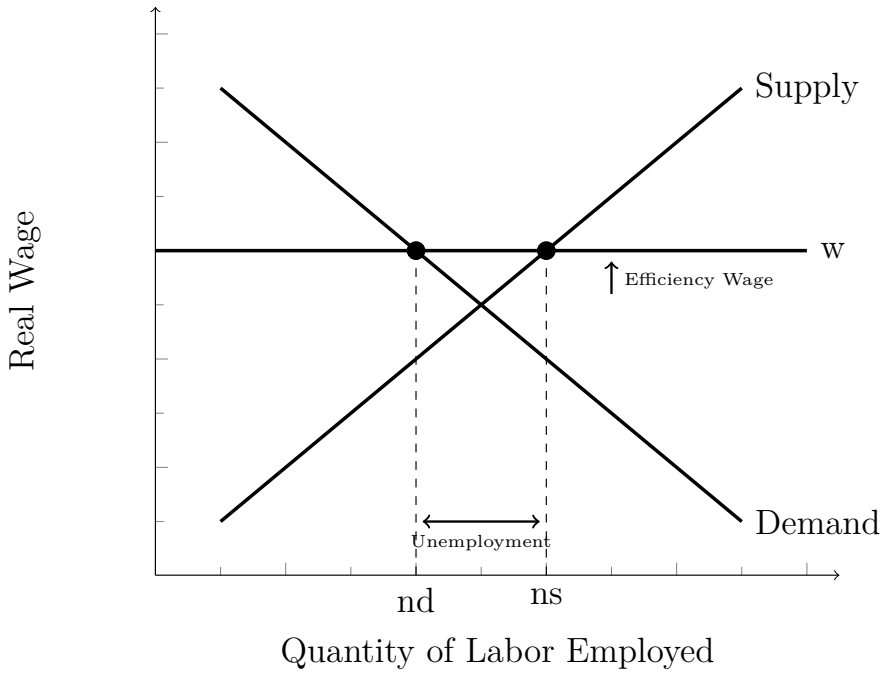

Figure 2: Unemployment in the efficiency wage model

In the efficiency wage model an increase in real wages causes a labor market disequilibrium and results in unemployment. Ns is the quantity of labor supplied, nd the quantity of labor demanded. Reproduced from Shapiro and Stiglitz (1984).

Although the unemployment rate plays an important role in economic policy, uncertainty remains. Mankiw (2014, p. 148) summarizes:

> In the end, the trends in the unemployment rate remain a mystery.

And Borjas (2008, p. 487) states:

> no single theory [...] provides a convincing explanation of why unemployment sometimes afflicts a large fraction of the workforce, of why unemployment targets some groups more than others, and of why some workers remain unemployed for a very long time.

The Covid-19 crisis severely hit economies worldwide and governments responded by increasing their spending and implementing different measures to stabilize the demand for labor. The economic crisis caused by the pandemic led to a drastic increases in unemployment rates: from 6.6% in 01/2020 to 7.7% in 08/2020 for the EU-27 and 3.3% in 01/2020 and 4.5% in 08/2020 for Germany,[4] which caused a call for active labor market policies in the academic literature (Blanchard, Philippon, et al., 2020; Tcherneva, 2020a). The most vulnerable groups are the informal workers, low-wage workers and self-employed, as well as people working in

[4]https://ec.europa.eu/eurostat/databrowser/view/UNE_RT_M___custom_1089162/default/line?lang=en, last visited on 22/06/2021

sectors that experienced strong decreases in demand (Avila and Mattozzi, 2020). To support those groups, governments launched different packages.

The federal government in Germany implemented a recovery budget, including easier access to short-term work at an early stage, which was aimed at preserving jobs and absorbing income losses for workers.[5] The payments for unemployed individuals, whose benefits would have ended during May and December 2020, were extended.[6]

Such support schemes were not uncommon during the pandemic. The US government reacted by increasing unemployment benefits through several stimuli packages: the 'CARES' Act included 268 billion dollars to increase unemployment benefits; which were expanded by 44 billion dollars in August 2020. It followed a temporary payment of $300 weekly to the unemployed and a one-time transfer of $600 to every citizen. In March 2021, President Biden put into place the 'American Rescue Plan' which includes, among others, direct transfers to the unemployed, as well as stimuli packages to low-income families.[7]

Similarly, the French government did launch budget laws in order to overcome the economic crisis: the French economy shrank by around 8% in 2020. Besides spending targeting the health infrastructure and support for companies, the packages included financing of short-time work schemes and direct transfers to low-income households. Unemployment benefits that expired during the lockdown were prolonged.[8]

The efficiency of transfers to households is also supported empirically (Faria-e-Castro, 2021). Using a nonlinear DSGE model, the authors model the economic crisis as a shock to the contact-intensive sector. Evaluating fiscal policies and their stabilizing effect on the economy, they find that transfers to households are the most effective. A targeted increase in unemployment benefits turns out to be the most effective policy aimed at stabilizing household income (Faria-e-Castro, 2021).

All these direct labor market interventions aimed at reducing unemployment rates do share the common characteristic of being rather short-term and are unlikely to be prolonged after the crisis (McGann et al., 2020). There is a call for new policy toolkits and active labor market policies in the literature: Blanchard, Philippon, et al. (2020) proposes temporary wage subsidies by the states in order to reduce the effect of productivity shocks and to limit layoffs, Ehnts and Paetz (2021) mention a Job Guarantee as a supplement policy if government expenditures

[5]https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#G, last visited on 23/06/2021

[6]https://www.bundesregierung.de/breg-de/aktuelles/sozialschutz-paket-2-1746396, last visited on 23/06/2021

[7]https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#G, last visited on 23/06/2021

[8]https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#F, last visited on 25/11/2021

are not high enough to overcome the consequences of the crisis on unemployment. Tcherneva (2020a) suggests better job protection as well as job creation policies.

3 The cost of unemployment

The consensus remains that a certain level of unemployment is required to fight inflation at least in the short run (Wisman, 2010). However, as unemployment is more than a simple macroeconomic feature, the following section distinguishes between personal and public costs. Several authors argue that the inflation target in economic discussion weighs more than the unemployment rate, which has resulted in persistent, high unemployment rates among European and OECD countries (Mitchell, 1998). The main point of criticism is that the cost of unemployment are mainly invisible and not being considered in standard macroeconomic policy (Tcherneva, 2018).

On the private side, unemployment does not only cause a loss of income: the literature finds that the non-financial cost goes beyond the financial loss from unemployment (Clark and Lepinteur, 2019). On the public side, labor market spending displays a high fraction of governmental expenditure in European countries: 1.39% of GDP in Germany and 2.87% in Denmark.[9] To evaluate these costs more precisely, the following section differentiates between personal and public costs arising from unemployment.

3.1 Personal costs

During periods of unemployment, people "unlearn by not doing",[10] i.e. not being challenged from a job yields skill depreciation (Sen, 1997, p. 161). When re-entering employment after a period of unemployment, evidence shows how these individuals experience a wage drop. Not only are there wage losses after resuming employment, there exist even long-run penalties: evidence from Great Britain shows the effect of youth unemployment on future wages and finds a wage scar of between 13% and 21% at the age of 41 (Gregg and Tominey, 2005); Arulampalam (2001) finds a wage scar of 6% when re-entering employment using British data; evidence from Germany supports these findings and shows that the wage loss is higher than the pure effect from a loss in human capital which is justified most likely by stigmatization (Beblo and Wolf, 2002). Similar results are obtained by Di Tella et al. (2003): using survey data from 12 EU countries and the USA, they provide evidence for lower life satisfaction caused by higher unemployment rates.

Estimating the costs of a recession, they find that people also suffer from the fear of unemployment. Higher unemployment rates make it more difficult to find a job in the case of

[9] https://data.oecd.org/socialexp/public-spending-on-labour-markets.htm, last visited on 02/09/2021

[10] opposed to learning-by-doing

unemployment. Further, the authors find that becoming unemployed equals a yearly loss of income of approximately $3,800 (Di Tella et al., 2003). Faberman et al. (2017) use the Survey of Consumer Expectations from the US and evaluates the different search behavior and outcome between employed and unemployed workers. Although unemployed individuals search at higher intensity, they "receive fewer offers per job application, and conditional on an offer, they are offered lower pay, fewer benefits, and fewer hours" (Faberman et al., 2017, p.1). The average wage offer they conduct is 24% lower for searchers currently in unemployment than for those in employment. Despite these low wage offers, the acceptance rate is high, which can be explained by a lower reservation wage. This evidence shows that it is difficult for jobless people to reenter employment.

People that are unemployed have less freedom of choice, meaning that some opportunities are simply not reachable for them. This lack of freedom occurs in social life when a lack of income does not allow to join social activities and participate in the community. This is what is labelled 'social exclusion'. Not being in employment can also create psychological harm and a loss of self-confidence (Sen, 1997). The long-term consequences also induce lower chances of finding a job in the future. There is evidence that unemployed persons get more resigned and find it more difficult to search for jobs the longer they are unemployed. These developments make it more likely that these individuals are going to suffer from unemployment in the future again (Sen, 1997).

Unemployed persons do have lower levels of personal fulfillment. The German Socio Economic Panel[11] does allow to draw conclusions on life satisfaction. Winkelmann (2014) finds that the most unsatisfied people[12] are also the least effective ones in their job search, implying that the unemployment spell will further increase. Life satisfaction does not increase over the period of unemployment, hinting that people do not get used to their situation. The robustness of these findings relies on longitudinal observations.[13] which prevent individual characteristics to cause a bias (Winkelmann, 2014). The author concludes that finding a job increases satisfaction by more than financial compensation during unemployment spells. A paper from Germany supports these results, finding that unemployment lowers overall life satisfaction (Gerlach and Stephan, 1996). Using British cohort data, Clark and Lepinteur (2019) evaluate the causes and consequences of unemployment on young adults. They find that unemployment periods have a scarring effect, even in the long-run. Survey participants that had a period of young-adult unemployment, no matter when, show reduced life satisfaction at the age of 30. Determinants of unemployment experiences are found to correlate with family background and childhood characteristics, as well as emotional health. They find that unemployment is passed on over generations significantly (Clark and Lepinteur, 2019).

[11] survey in Germany, conducted by the 'Deutsches Institut für Wirtschaftsforschung' (DIW), short: SOEP
[12] the paper does not differentiate between the term life satisfaction, happiness and well-being
[13] monitoring individuals' satisfaction over time

3.2 Public costs

Costs from unemployment are also relevant on an aggregate level. Although these costs are largely invisible, they create negative externalities for the society and exceed the pure costs for those currently in unemployment (Tcherneva, 2018; Frey and Stutzer, 2010).

First, unemployment reduces output (Sen, 1997). Mitchell (2012) computes the daily GDP loss from unemployment during the Great Recession in the USA, finding a loss of 9.7 billion US dollars.[14] Using a similar method, Watts and Mitchell (2000) evaluate the costs from unemployment in Australia. They compute an annual productivity loss per unemployed aiming to work on a full time level of around US$79,000 (Watts and Mitchell, 2000).

Unemployment has also negative effects on jobs: evidence from Australia highlights the negative effect from unemployment on employment regulation and job quality (Burgess and De Ruyter, 2000).

Furthermore, there is evidence on the relationship between unemployment and crime as detected by Gould et al. (2002). Using an instrumental variable to control for the potential endogeneity of labor market condition on local crime rates, the authors were able to pin down a causal relationship for the USA from 1979 to 1997. Similar evidence for France shows a positive correlation between unemployment and crime, as well as that an increase in youth unemployment leads to an increase in crime. The model shows a similar relationship between unemployment and theft, as well as unemployment and burglaries (Fougère et al., 2009).

Unemployment can further cause tension in the society. "Since immigrants are often seen as people competing for employment (or 'taking away' jobs from others), unemployment feeds the politics of intolerance and racism" (Sen, 1997, p. 164). As additional cause of unrest, structural unemployment yields negative effects on income inequality as found by Mocan (1999). Not only does it negatively affect income inequality, unemployment also intensifies inequality between labor and capital (Tcherneva, 2014).

4 The concept of a Job Guarantee

4.1 The general idea

To overcome the problem of involuntary unemployment, which can cause societal and personal issues as shown in the forgone chapters, the idea of a Job Guarantee is prominent in the economic literature. A variety of papers approached this topic using a multitude of labels, including "buffer stock employment" (Mitchell, 1998), "public service employment" (Forstater, 2003),"employment of last resort" (Wray, 2006) or "guaranteed job program" (Wisman, 2010).

[14] http://bilbo.economicoutlook.net/blog/?p=17740, last visited on 25/11/2021

In this thesis, the underlying concept is coined by the term *Job Guarantee*. All of these concepts share the same idea: overcoming involuntary unemployment by creating an infinitely elastic demand for labor by the state. It is important to note is that it is not a 'workfare' program, implying that people would have to work in order to receive their social benefits, but rather have an option to exit unemployment. The goal is further to enable social inclusion through a job (Kaboub, 2007).

With a Job Guarantee, the state offers employment to anyone willing to work at a certain wage. By this, a lower limit to the price of labor is being set (Kaboub, 2007). This can have an impact on the private economy, especially in the low-wage sector. As workers do have an outside option, it is being argued that an increase in the bargaining power of workers takes place (Kaboub, 2007). In an economy without JG, the hiring behavior of firms depends on the business cycle and profit expectations, workers suffer from recessions (Minsky and Kaufman, 2008). With a Job Guarantee, the pool of workers in the public program will increase during recession; in times of economical booming, the pool will get smaller (Kaboub, 2007).

The reasoning of unemployment being a consequence of low demand for output and the option of demand stimuli as counteracting tool is refuted in Wray et al. (2018): demand stimuli à la Keynes are not sufficient as markets respond with what is called a labor market slack[15] shown by evidence from the USA (Wray et al., 2018). This lack of demand for labor causes persistent levels of unemployment and calls for job creation policies in order to strain the supply of low-skilled workers. As such, firms would be incentivized to invest in technologies that would increase the productivity of labor and to improve their working conditions (Wray et al., 2018).

The creation of jobs for the Job Guarantee is proposed to be designed bottom-up, implying that local agencies and regional non-profit organisations would create jobs where needed. The idea is not to replace existing public sector work, but to create different job opportunities on a local level. Additionally, the government could subsidize firms which hire workers through the Job Guarantee program (Tcherneva, 2018; Gordon, 1997). Precisely, Tcherneva (2018) proposes to create a 'Community Job Bank' for the United States and offers three job categories: environmental, community-targeted and jobs for the people. Environmental jobs could consist of flood control, local agriculture projects or the creation of community gardens. Community job workers would improve public spaces, for example by constructing playgrounds, the renewing of historical sites or initiating projects against food waste. The jobs aimed at supporting people could consist of elderly care or after-school programs (Tcherneva, 2018). As different jobs require different skills, a strong cooperation between the job agencies is required. To match the workers most efficiently, a screening-process of all workers searching for a job needs to be conducted. In every case, the job agencies must provide training for jobs requiring very specific

[15] "the unmet demand for paid labor within a given population" from https://www.eurofound.europa.eu/observatories/eurwork/industrial-relations-dictionary/labour-market-slack, last visited on 27/09/2021

skills such as elderly care. Jobs designed to achieve environmental sustainability are proposed by Forstater (2003). The author argues that these kinds of jobs are usually labor-intensive and would therefore well fit for the creation of new jobs. Examples for environmental jobs mentioned are recycling on a community or industrial level, the remodelling of houses and offices to more sustainable and energy-efficient buildings or urban landscaping (Forstater, 2003).

If the state acted as an employer, a large workforce would be available in case of catastrophes or adverse events which require such a large workforce. For natural catastrophes, waves of refugees or pandemics, the state would be better prepared and could shift responsibilities away from voluntariness or the national army.

There exist various approaches to define the group of eligible persons. At this point, the literature can clearly be divided into two fields: those, proposing a Job Guarantee to anyone willing to work (Tcherneva, 2020b); and those defining eligibility criteria such as age, duration of unemployment spell or other factors and proposing a Job Guarantee as a sociopolitical instrument to the unemployed (e.g. Picek, 2020; Lietzmann et al., 2018). In any case, the more restricted the criteria are, the bigger the threat of excluding potential candidates (Lietzmann et al., 2018), and consequently, the smaller the aggregate effect. Previous work argues that the number of people joining the public labor force would be higher than the number of officially registered unemployed: Sawyer (2003) puts emphasis on the "hidden unemployment" (Sawyer, 2003, p. 889)[16] and concludes that the number of real unemployed workers is much higher.[17] However, there are contrary opinions in the literature. Although there might be more unemployed persons than officially reported, the Job Guarantee is likely to have a stabilizing effect on the overall economy which would downsize the pool of workers in the public program (Tcherneva, 2018).

4.1.1 Cost estimations

A variety of papers conducts cost estimations for a Job Guarantee. For Germany, Landwehr (2020) considers four different scenarios: a Job Guarantee for the long-term unemployed (1), for all unemployed (2), for underemployed persons (3) or for all underemployed (4) and "1.8 millions workers of the low-wage sector which earn less than the minimum wage" (5) (Landwehr, 2020, p. 17). For each of these cases, government spending for the Job Guarantee are calculated as a fraction of GDP. Additionally, the increase in GDP is taken into account by considering a fiscal multiplier of one, hence the budget spending[18] would increase GDP by the exact same

[16] agents who do not meet the criteria for unemployment but are willing to workhttps://www.statistik.at/web_en/statistics/PeopleSociety/labour_market/unemployed_seeking_work/willingness_to_work_labour_reserve/index.html

[17] about 50% higher than the official numbers in Australia and about 2.6 times the unemployment rate in the United Kingdom

[18] required to finance the JG

amount. To include the increase in tax revenue, Landwehr uses an average tax rate of 21.42%. As such, the increase in tax revenue from the raise in GDP resulting from the fiscal multiplier are considered. Further, a reduction in social transfers by 29.8% outweighs the cost of the program. For the fourth scenario, including the largest group of potential workers, Landwehr computes costs of 3.00% of GDP, not considering tax income. The average costs lay at 2.36% when considering the tax income. If the public employment would only serve the long-term unemployed, the estimated costs lay at 0.24% of GDP, again without additional tax income; at 0.19% with tax income included. The author justifies this case differentiation arguing that it might be difficult to sell the increase in taxes politically.

Picek (2020) performs a hypothetical simulation for Austria and estimates related costs. In his scenario, long-term unemployed are eligible and a case differentiation is being conducted based on different wages that would be paid. Comparing several possible gross minimum wages ranging from €1,300 per month to €1,700, and the average pay from the 'Aktion 20,000'[19] (€1,812) estimated costs range from 0.19 to 0.33% of GDP. To emphasize the costs that would become obsolete when introducing a Job Guarantee, the author computes the costs from monthly long term unemployment benefits without a Job Guarantee. The self-financing rate of the program lays at 63.10% for the lowest (€1300 monthly wage) and at 48.64% for the 'Aktion 20,000'-wage. Indirect effects from the fiscal multiplier are missing in the analysis and would further lower the costs.

A cost simulation has also been conducted for Greece (Antonopoulos, 2014). Different scenarios are being compared, depending on the number of jobs that would be created. The analysis puts emphasis on the net costs. As the creation of new jobs also increases tax income, around 770,000 jobs could be created at a cost of 2.2% of GDP. More precisely, the study takes indirect and direct tax income into consideration. Whereas indirect taxes cover tax income "generated from the multiplicative process" (Antonopoulos, 2014, p. 52) and direct tax income stems from the labor income taxes paid on Job Guarantee wages.

Further cost estimations obtain comparable results: 2% of GDP for France (Attali and Champain, 2005), and for the United States 2.4% of GDP (Tcherneva, 2018) or just less than 3% of GDP as found by Paul et al. (2018). Although these papers consider the multiplier effect, as well as the reduced costs paid for unemployment benefits, the costs may still overestimate the real costs: Kaboub (2007) emphasizes that also indirect costs from unemployment will be reduced, such as reduced health costs or costs arising from criminal activities. However, these benefits might be difficult to measure.

[19] See Hausegger and Krüse (2019) for an evaluation of the policy.

4.1.2 The inequality-reducing effect

Likewise, a job guarantee program would likely reduce inequality and risk of poverty, as it especially benefits the most vulnerable groups. A Job Guarantee is a key instrument in combating income inequality since it increase the labor income share compared to capital income. For those in employment, wage differences are being reduced (Tcherneva, 2018). Next, particularly low-skill individuals, the unemployed and people working less than full time for economic reasons[20] or belonging to the vulnerable group of workers[21], are being offered an employment safety net (Tcherneva, 2018). Empirical evidence for the USA is provided by Wray et al. (2018), they find that at a wage of $15 per hour, "one full-time worker could lift a family of up to five out of poverty" (Wray et al., 2018, p. 7). Haim (2021) finds a reduction in the share of people at the risk of poverty in Austria,[22] of around 10 percent. A strong gender dimension of the Job Guarantee was found in Azam (2011) evaluating the effects of a public employment program in India: an increase in the labor force participation as well as an increase in average wages of women resulted from the program.

4.1.3 The inflationary aspect

A common concept in the discussion surrounding the Job Guarantee is the notion of a 'non-accelerating inflation buffer stock employment ratio' (NAIBER). Similar to the concept of the 'non-accelerating inflation rate of unemployment' (NAIRU), it is argued that the stock of workers employed in the public program can serve as an inflation-stabilizer. The buffer stock of employment grows in case of rises in interest rate for example. A fraction of workers would lose their job and be transferred to the public employment where they received a fixed wage, set by the government. In the NAIRU setting, the inflation stabilizing role is shifted towards the unemployed, whereas in a scenario with a public employer, it would be carried by the workers in the Job Guarantee. Therefore, by choosing the fixed wage, the government could stabilize price changes, whereas simultaneously the high costs from unemployment are being avoided (Mitchell, 1998). The downside of the NAIBER economy is that economic activity is shifted from the private to the public sector, and therefore to the usually less efficient sector. This could cause a decrease in productivity growth which could deteriorate trade. Hence a trade-off of productivity versus inflation is being created (Mitchell, 1998).

Critic arises from Post-Keynesian Economics stating that a Job Guarantee politicizes the unemployment rate and is shifting it away from a purely macroeconomic policy tool, whereas still accepting that there is a relationship between employment and inflation (Ramsay, 2002a).

[20] The inability to find full-time employment due to the economic situation.

[21] long-term unemployed, people with disabilities or similar

[22] "Persons are considered to be at risk of poverty after social transfers, if they have an equivalized disposable income below the risk-of-poverty threshold, which is set at 60 % of the national median equivalized disposable income"(https://ec.europa.eu/eurostat/web/products-datasets/-/sdg_01_10, last visited on 19/06/2021)

A Job Guarantee sets a lower bound to the compensation of labor. It will affect wages below the wage paid for a job in the public program and can cause a one-time shift of wages. On the contrary, it could also cause a one-time price and wage decrease if the public job program would "replace a higher minimum wage and 'welfare' package" (Mitchell and Wray, 2005, p. 4). These inflationary developments are being modelled in several publications and considered next.

A vast amount of literature is estimating the economic response to a Job Guarantee focusing mainly on the inflationary aspect. The theoretical work by Wray (2006) models an economy with an Employer of Last Resort (ELR) and concludes that it is possible to achieve full employment without causing price instability. Underlining that an ELR is even more efficient in stabilizing inflation than a pool of unemployed. This feature allows the government to set the price for labor without causing a sudden increase in general price level (Wray, 2006).

Wray et al. (2018) conclusively show the inflationary effect of a public sector employment (PSE) model on the US economy. Their study demonstrates that the large increase in GDP, as well as the increase of the effective minimum wage (that would occur if the PSE wage was higher than the minimum wage) that would go hand in hand with a PSE, has only non-significant effects on inflation. They observe a peak in inflation by 0.74 percentage points in the year of introduction. This impact lowers down to 0.09 percentage points seven years later. The authors conclude that the movement to full employment "temporarily boosts inflation, which then falls essentially to 'white noise' as full employment is maintained through PSE" (Wray et al., 2018, p. 6).

Fullwiler (2007) simulates the aggregate macroeconomic effect of the introduction of an employer of last resort as a shock to the Fairmodel.[23] Finding that the stochastic equations were not changed after the introduction, the author concludes that an ELR would have a stabilizing effect. The stabilizing effect of the public employment program would only work if the buffer stock of employers could fluctuate flexibly, implying that only a small amount of workers would be hired permanently. The author further emphasizes that the output produced by the workers must be productive in order to ensure this stabilizing effect. If effectively implemented, an employer of last resort would stabilize the economy automatically (Fullwiler, 2007).

4.1.4 Expected Benefits

Having explained the negative consequences from unemployment above, the positive impacts stemming from a Job Guarantee should be emphasized. Crucial for the unemployed is the fact that a job within the Job Guarantee will not only counteract the depreciation of human capital which usually occurs in periods of unemployment, but will also enhance chances of receiving a

[23] A dynamic, nonlinear, simultanoues macro-econometric model developed by Ray Fair in the 1970s. See Fullwiler (p.94-95 2007) for further explanation.

job offer outside the program (Wray et al., 2018). Especially the quick technological progress can make it difficult for low-skilled workers to keep up, making training in periods of non-private employment a crucial component of the program (Wisman, 2010). As on-the-job training is a key component of the program, workers will face higher chances of being recruited into the private labor market (Wray et al., 2018).

A guaranteed job serves as a method to prevent the illness occurring from unemployment. As evidence from the program in Argentina[24] shows, people working do not state that their satisfaction with the program is derived from the income earned. Primarily it follows from the fact that they "can do something", secondly that they "can work in a good environment" and thirdly, because their labor serves the community (Tcherneva, 2018, p. 31). This also supports the argument that financial support to unemployed only, will not have the same effect (Tcherneva, 2018).

A Job Guarantee not only has positive impacts on the workers, but also on the local community in which the work is done. Local needs could be fulfilled as well as whole districts could increase in social value (Wray et al., 2018).

Furthermore, the policy creates pressure on wages and makes firms offer fair wages, and consequently, the state employment establishes a wage standard in the market. As the Job Guarantee creates the opportunity to get a job at a certain wage for all people willing to work, this would create a new lower-bound for wages. The job option would further enable workers to exit precarious working conditions. The employer would no longer be able to threat with unemployment in case of job loss, hence, workers can refuse exploitative contracts. The proposed labor market policy would turn from workers competing for jobs to firms competing for workers (Tcherneva, 2020a).

Especially in times of crisis, such as during the Covid-19 pandemic when firms laid off workers as a response to the decrease in demand, a Job Guarantee can work as a "countercyclical tool" (Tcherneva, 2018, p. 10). People working in flexible working contracts would not have to fear unemployment when losing their jobs. Additionally, unemployment numbers would never have reached the pre-crisis level (Tcherneva, 2018). The stabilizing effect does not only work in the short-term but also in the long-run, and thus, a guaranteed job ameliorates market expectations (Kaboub, 2007).

[24]Plan Jefes (Tcherneva, 2018)

4.1.5 Prominent Critics

However, a Job Guarantee is exposed to criticism in the literature too, as the friction-free and efficient matching process of employer and employee may be hindered, resulting in the potential effects described below.

If private and public jobs were close substitutes, a Job Guarantee program could cause a massive crowding-out effect of private jobs as found by Algan et al. (2002). They found that for OECD countries the creation of 100 public jobs would cause a loss of 150 jobs in the private economy. Although this research seems relatable to the introduction of a Job Guarantee, the substitutability of jobs in the private and public sector would not be given. Further, the wages and benefits in the public program do not exceed those for private jobs (on average), for which the authors' findings are not significant.

With no doubt, a Job Guarantee would improve the bargaining position of workers. The workers in private employment may demand higher wages when earning less compared to the public job option. If they lost their jobs, they would still find employment (Ramsay, 2002a). This could present a threat for firms, especially for those operating in the low-wage sector.

Critics also arises from the "economic usefulness of the jobs to be created [...] and the transferability of the skills learned under the program to the private sector" (Kaboub, 2007, p. 13). Difficulties could further arise from uncooperative workers due to their different social backgrounds (Ramsay, 2002b). Workers employed in the Job Guarantee might experience stigmatization which could, if perceived so by private employers, yield to difficulties when reentering private employment. This "public service stigma" would have to be counteracted by an effective training component as well as a good image of the program in the population (Bradley et al., 2017, p. 1220).

4.1.6 International experiences

Attempts comparable to a Job Guarantee already exist in some countries. The following section summarizes experiences from France and Austria in more detail as these countries can serve as a showcase model for Germany. In general, also other countries like India (Azam, 2011), Argentina (Kostzer, 2008) or Greece (Antonopoulos, 2014) introduced Job Guarantees in the past.

The French government launched a pilot project in 2005. In the first years, six departments participated in the program (Kaboub, 2007). By the end of 2019, already 10 regions participated.[25] The target group consists of long term unemployed persons. As such, the program is aimed to function as a transitional program to private employment. During the program,

[25] https://etcld.fr/wp-content/uploads/2020/06/ra-etcld-2019.pdf, last visited on 17/06/2021

workers are being paid the same wage as in their previous job. Together with guaranteed employment, the program contains a strong training component to prepare workers for different jobs (Kaboub, 2007). Estimations show that the program's costs did not raise government spending and were covered by unemployment insurance contributions. Whereas 4.2% of GDP are spent for unemployment costs and other labor programs in France, the estimated costs for this program account for 4% only (Attali and Champain, 2005). The workers are either employed in a public company aimed at hiring employees from the program, or they find work at local firms. In total, 12 employers of last resort[26] have been created until the end of 2019, hiring around 920 workers.[27] The program is constantly evaluated and allows drawing conclusions about its success.

A similar pilot project was introduced in Austria in 2018, labelled 'Aktion 20,000', aimed at creating 20,000 jobs for long-term unemployed.[28] Due to a change in government, the program ended after six months. Until the end of the program in 2019, around 4,000 people were hired through the project. Existing local employers have been successfully integrated into the project (Hausegger and Krüse, 2019).[29] Remarkably, also after the end of the funding, on average 32% of the participants remained in employment (Walch and Dorofeenko, 2020). A study further concludes that higher costs arising from the active labor market policy, are being payed off after 45 months due to higher tax income and reduced social spending (Walch and Dorofeenko, 2020). A new project has been launched in Vienna, targeting unemployed older than 50. In contrast to the previous program, workers can also join private firms. The government finances the wage costs in the first 12 months of employment.[30]

4.2 The case for Germany

In Germany the 'social income' pilot project in Berlin is most comparable to a Job Guarantee and offers employment to 1,000 long-term unemployed persons (receiving unemployment benefits Type II). Participation in the program is voluntary. Not only does it enable social inclusion and a fixed income for the participants, it also increases social cohesion in the city, as the projects are aimed at benefiting the local community (Bach and Schupp, 2018).

Cost estimations were being conducted for the introduction of such a program on a national level. Bach and Schupp (2018) estimate a cost of between 500 and 750 million euros for 100,000 to 150,000 participants, putting emphasis on the fact that positive effects for the participants

[26] employers in the Job Guarantee program

[27] https://etcld.fr/wp-content/uploads/2020/06/ra-etcld-2019.pdf, last visited on 17/06/2021

[28] See section 4.1.1 for further details on 'Aktion 20,000'.

[29] in some cases the jobs were created newly in existing occupational structures (39%), in others, complete new work fields were created in the company (27%). In 14% of the cases data is lacking (Hausegger and Krüse, 2019).

[30] full subsidy in the first six months, 66.7% in the next six months (https://www.waff.at/joboffensive50plus/, last visited on 09/06/2021)

are hard to estimate but would technically reduce these costs. Furthermore, in this scenario, declining costs are not considered and a comparison with other cost estimations as in section 4.1.1 is difficult.

Landwehr (2020) estimates different scenarios depending on the target group: only long-term unemployed, all unemployed, underemployed and all underemployed workers plus 1.8 million workers from the low-wage sector, and thus, assumes a much higher participation compared to Bach and Schupp (2018). Overall, for the group of long-term unemployed (714,000 persons in 2020), he calculates costs of 6.51 billion euros for the state. See subsubsec: cost estimations for an extensive overview of Landwehrs' cost estimation.

The German government has been providing unemployment insurance since 1927, financed by taxes and transfers. With the raise of unemployment rates after the Second World War, active labor market policies were put into place. The unification of Western and Eastern Germany raised unemployment rates. In order to overcome the resulted economic consequences, stronger labor market interventions were introduced. Since the introduction of unemployment benefits in Germany, the unemployment payments had been related to income. Hence, they depended on the social status of the worker before the period of unemployment. In the first period of unemployment the state had paid for the unemployment benefits, which were followed by a payment of unemployment assistance. In this period, the incentive to reenter a job was rather low as additionally earned income strongly reduced the assistance payments (Lechner et al., 2005). These labor market policies created high governmental expenditures together with long duration of unemployment. In the 1990s, the main policies were accompanied by training and job creation policies (Jacobi and Kluve, 2006).

The *Hartz-IV-Reform*, implemented from 2002 to 2005, presents a watershed in the German labor market policy and led to restructuring of the unemployment agencies on the one hand, as well as adjustments of policies on the other hand. The reform consisted of a restructuring of the employment agencies in order to increase efficiency, policies aimed at activating the unemployed, as well as labor market deregulations (Jacobi and Kluve, 2006). The active labor market policies were adjusted in terms of target group: job creation policies were only available for people who were assumed to remain unemployed in the short term. Unemployed persons receive "benefit Type I in the first 6 to 12 months of unemployment. Thereafter, the person receives the lump sum means-tested benefit Type II" (Jacobi and Kluve, 2006, p. 12). Compared to the unemployment assistance payments prior to the reform, the benefit Type II is not income related and lower overall. People able to work (no sickness, disability etc.) must accept any job offer that fits the skills. If refused, sanction elements cause a reduction in benefits. As such, the reform was directed at integrating job seekers directly back into the labor market and put more responsibility and pressure on the job seeker (Jacobi and Kluve, 2006).

One active labor market policy were the job creation policies, which were introduced in 1969 and ended in 2009.[31] This policy was introduced in order to respond to high unemployment rates and occurs in the debate surrounding a Job Guarantee in Germany, since the two policies seem similar at a first glance. Employment relations on the so called second labor market[32] were financed by the state.[33] The goal of this program was to increase the income of the participants, as well as to facilitate entrance in the first labor market. The jobs were not restricted to a specific target group and required different skill levels. Overall, the job creation scheme had a negative image, as workers did not reenter the first labor market but where "locked in" the public employment program (Afscharian and Irmler, 2019). Although the program was introduced in 1969 already, scientific analysis was only possible several years later due to a lack of data. The goal of the policy was to facilitate entrance into the regular labor market and therefore this is being quantified in most of the studies. Using a data set from the Federal Employment Service, Caliendo, Hujer, et al. (2004) evaluate the effects from participation in the job creation program on the success of reentering unsubsidized employment. The data set used contains information on a treatment group of unemployed who joined the program in 2000, as well as a group of unemployed individuals who did not join. For both groups, the authors compare the outflow into regular employment and find that the reintegration by the means of a job creation policy was not successful (Caliendo, Hujer, et al., 2004). Considering the success of reemployment, Hujer and Thomsen (2006) emphasize distinguishing between subgroups: they find positive reemployment effects for long-term unemployed, for persons with health issues as well as for persons working in social work or in the service sector. Overall they find an insignificant effect on the probability of reemployment for men but a positive effect for women in Western Germany. For Eastern Germany, they find negative effects for men and women, which the authors lead back to the worse situation of the Eastern labor market. In general, the authors criticize the program, as it disincentives to search for regular jobs outweighed the benefits from prevention of the loss of human capital.

The negative evaluations of the ABMs caused a discussion on how to implement such job creation policies more efficiently. Hereby, Hardes (1988) emphasizes the role of the local agencies in order to best respond to local needs of the labor market and the economic development. Hujer and Thomsen (2006) underline that the skills of the workers within the program had to be useful for the private labor market.

The job creation scheme and the Job Guarantee, such as the social income project in Berlin, differ in several points: The goal of the job creation scheme was to increase employability

[31] called "Arbeitsbeschaffungsmaßnahmen", short ABM in German.

[32] were the second labor market refers to the labor market where jobs are being financed through public money, as opposed to the first labor market which covers regular employment relations

[33] https://www.bpb.de/nachschlagen/lexika/lexikon-der-wirtschaft/21231/zweiter-arbeitsmarkt, last visited on 06/09/2021

of the participants and to stabilize the labor market (Lietzmann et al., 2018). Its purpose was to facilitate transition into the first labor market, which was not successful, as people in the program did not have time to search for regular employment (Afscharian and Irmler, 2019). By contrast, the aim of the social labor market in Berlin is sociopolitical: the idea is to enable participation in the professional life for people that had especially low chances of reentering the labor market (Lietzmann et al., 2018) and is aimed at supporting the search for a regular job (Tcherneva, 2018). Another point of critique stems from the usefulness of the created jobs, which go hand in hand with the positive psychological effect that follow from meaningful employment. The positive experiences made in successful Job Guarantee programs as for example in France,[34] or in Argentinia (Tcherneva, 2018) underline these findings and support the critique of the ABMs where jobs were not sufficiently created in a bottom-up manner (Hardes, 1988).

The negative experience from the job creation policy, as well as the study results suggest to limit the group of eligible persons efficiently when introducing a Job Guarantee in Germany. Lietzmann et al. (2018) argue that such policies should target people with difficulties to enter a regular employment relation. For this group, the gain of social inclusion is of utmost importance. For people easier to integrate in the private labor market, the threat of lock-in effect would be too high (Lietzmann et al., 2018). Knuth (2018) underlines the necessity of a restricted target group in order to use the spending most efficiently and to reduce effects for private employers. To ensure the positive effect of social inclusion, the voluntary nature of the policy is crucial (Christoph et al., 2015). The project in Berlin implements these framework conditions efficiently and only targets long-term unemployment and ensures voluntariness. Not participating in the program does not have any consequences on social benefits (Schupp, 2018).

4.3 Conceptual design

The implementation of a Job Guarantee involves many actors and institutions as displayed in Figure 3. This thesis considers the German labor market from now on and designs the Job Guarantee for the German case.

In the setting considered here, a Job Guarantee would be available to all unemployed persons. The key institution here is the federal Job Agency which manages the demand and supply for jobs within the program. The introduction of a Job Guarantee would have an effect on the bargaining power of workers and firms as well as on other actors (Murray and Forstater, 2012; Wisman, 2010; Tcherneva, 2018), which are not taken into consideration in this chart, as the goal is to clarify the flow of people.

[34] https://www.atd-fourthworld.org/zero-long-term-unemployment-zones-experiment-in-france-work-as-a-common-good/ last visited on 07/06/2021

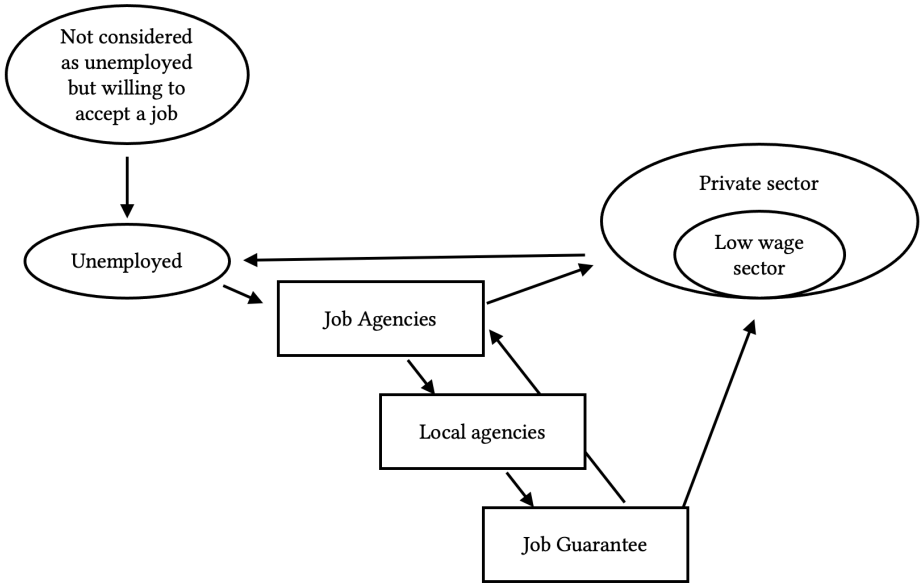

Figure 3: Conceptual design for a Job Guarantee in Germany

Round shape displays a group of agents in the economy, square form a labor market institution, flow of agents are displayed by arrows (own depiction).

Important to note is that not all people who might potentially be interested in a guaranteed job are currently in the state of unemployment. First, there is the group of so-called underemployed which contains unemployed people on the one hand, as well as people in training or in special status.[35] The introduction of a Job Guarantee could therefore cause an inflow of workers into the group of unemployed. Second, the program could also incentivize people out of the labor force who gave up searching and are not registered as unemployed anymore. A more realistic prospect of finding a job might also cause an inflow into unemployment from this group. Additionally, the Job Guarantee could cause an outflow of workers from the low-skill sector. This workers would enter unemployment to then be transferred into a public job.

After entering unemployment, several weeks of private job search could be mandatory; if unsuccessful, the individual could join the Job Guarantee program. People with a higher reservation wage than offered from the Job Guarantee, as well as those fearing reputational problems when accepting a job, would not take the job. The people working in the program would profit from on-the-job training, enabling easier transition into a regular job (Wisman, 2010). Every job created in the program should be aimed at facilitating job entry in the private labor market (Tcherneva, 2018). If there is a demand for jobs in the private labor market, employers

[35]People in special status are for example ill for a short period. See https://statistik.arbeitsagentur.de/DE/Navigation/Grundlagen/Definitionen/Arbeitslosigkeit-Unterbeschaeftigung/Unterbeschaeftigung-Nav.html., last visited on 25/11/2021, for the defintion.

would recruit workers out of the pool of workers in the Job Guarantee instead of from the pool of unemployed (Wray et al., 2018; Wisman, 2010).

The role of the federal job agency is to support individuals to find a job in the private labor market. With a Job Guarantee its area of action would increase, as it would also work as mediators to Job Guarantee jobs. Especially for jobs where special skills are needed (such as elderly care or working with disabled), the job agencies would have to check the workers for their appropriateness (Sawyer, 2003).[36] For the best mediation of workers, Tcherneva (2018) proposes a Community Job Bank which enables quick placement of workers into jobs, as well as enabling quick processing in case a job on the private labor market should be found. Several organizations would be in touch with the Job and or local agencies, and deliver the supply of jobs. Together with the job agencies, the agents should get at least one appropriate job offer (Tcherneva, 2018). When designing the jobs, the Job agencies should take into account that job search on the private labor market is time-intense and that agents would need enough time aside from work to do this (Sawyer, 2003). Therefore, job agencies would need to support agents to convey to private sector jobs.

5 A One-Sided Job Search Model with a Job Guarantee

5.1 Methodological classification

In order to evaluate labor market policies and agents' behavior, a multitude of labor market models exist in Economics (Rogerson et al., 2005). There are one-sided search models which deliver a partial equilibrium and there are two-sided models "in which workers and firms match in [a] general equilibrium, and [where] the wage distribution is endogenous" (Williamson, 1999, p. 91). The model presented here is one-sided and, hence, does not incorporate the employer-side. The economically efficient transition of workers depends on the agents' utilities. Therefore, it makes sense to evaluate how these utility functions change when incorporating a Job Guarantee into the model.

Other two-sided models have already incorporated state employment. One approach to consider a labor market intervention similar to a Job Guarantee was done by Holmlund and Linden (1993) evaluating the option of temporal public employment, similar to policies in Sweden[37] and in the UK.[38] The authors adopt a matching model with a third labor market to estimate the effects on the unemployment rate following the introduction of a public labor market.

Using data from Columbia, also Albrecht et al. (2019) expand another two-sided search model called the 'Diamond-Mortensen-Pissaridis model' by a public labor market. They do not con-

[36] The associated costs are not considered in this framework.
[37] so called relief jobs (Holmlund and Linden, 1993)
[38] the British Community program, which was abolished in the 1980s (Holmlund and Linden, 1993)

sider any sort of Job Guarantee, but the public (administration) jobs. The authors criticize the labor market literature arguing that the public sector is not reflected, despite its size.[39] In their paper, they evaluate the division of workers between the two sectors and trace it back to differences in education.

This work modifies a Job Search model in which agents have the option to enter the Job Guarantee when being unemployed. To the best of my knowledge, there is no one-sided search model incorporating a Job Guarantee as an option.

5.2 The Model

In this thesis, a one-sided search model from Williamson (1999) is used as reference model. In the original model, agents choose between two jobs in the private labor market at different wages and separation rates, where a separation rate refers to the probability of quitting the job. Similarly in the model presented, unemployed agents can choose from two different jobs: either in the public or in the private labor market. Here, the public labor market corresponds to the Job Guarantee sector. The private labor market consists of all jobs outside the Job Guarantee.

The model considers a continuum of rational, forward-looking agents who discount their future income at a positive interest rate $r > 0$, which yields a discount factor for future income of $\beta = \frac{1}{1+r} > 0$. Further, it is assumed that workers do not have a disutility from working, nor from searching for a job (Williamson, 1999). In periods of unemployment, the agents receive unemployment benefits ($z > 0$) from the state. When working in the private labor market, they obtain wage w ($w > 0$), when working in the Job Guarantee (JG), they receive wage w_{JG} ($w_{JG} > 0$). Workers search for a job at a fixed intensity and receive job offers at an exogenous arrival rate ($\lambda \in (0, 1)$) from the private labor market. When being unemployed, agents receive job offers from the JG at rate δ ($\delta \in (0, 1)$). When receiving a job offer from the private labor market, agents accept the job independent of the wage offer. When receiving a job offer from the JG, their decision whether to accept the job depends on the wage offer.[40] The flow from employment to unemployment is captured by the monthly separation rate (Faberman et al., 2017). Jobs are being destroyed at an exogenous rate which end the employment relation. Consequently, inflow into unemployment occurs from exogenously destroyed regular jobs ($q \geq 0$), or from expiring Job Guarantee employment relations ($x \geq 0$) (similar to Holmlund and Linden, 1993). For clarification of the transitory mechanics within the model, see Figure 4.

Depending on the labor market state, individuals face different options and therefore different utility functions (Cahuc et al., 2014). V signifies the discounted utility of the agent and its

[39] the average share of public employment in total employment among 17 OECD countries lays at 19% as found by Algan et al. (2002)

[40] This relates to a different definition of the two job offer arrival rate for the two sectors and assumed, as the goal of the model is to solve for a reservation wage above which agents accept a JG offer

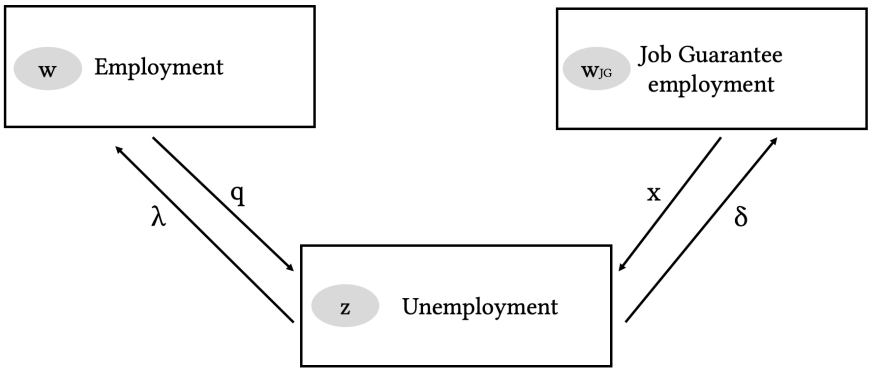

Figure 4: Labor market flows in the Job Search model

The group of unemployed receives a job offer from the Job Guarantee at rate δ, and at rate λ in the private sector. Jobs get destroyed at rate x in the Job Guarantee and at q at the private sector. When being in private employment, agents earn wage w, when being hired in the Job Guarantee, wage w_{JG}. When unemployed, agents receive benefits at level z. Own depiction based on Holmlund and Linden (1993).

subscript indicates the labor market state: e stands for private employment, u for unemployment, JG for a person working in the Job Guarantee. Important to mention is that the model only makes statements about what is economically efficient for the agent. Clearly, there are other factors such as social inclusion, satisfaction with the job or disutility from work, which are, however, not considered here.

Those working in a private job earn a wage (w) per period and in the subsequent period either stay in the job or lose their job (at rate q) and become unemployed, utilities are discounted at rate β. Comparing the risk of public and private jobs, it is assumed that private jobs are being cut off more often than public jobs, implying $q = x + \alpha$ with $\alpha > 0$, and they are therefore riskier.

$$V_e = w + \beta(1 - q)V_e + \beta q V_u \tag{1}$$

Workers in the Job Guarantee obtain a wage ($w_{JG} > 0$) and in the next period either stay in this job or become unemployed. The job separation rate (x) in the public program can be interpreted as jobs expiring when, for example, projects end.

$$V_{JG} = w_{JG} + \beta(1 - x)V_{JG} + \beta x V_u \tag{2}$$

Unemployed agents receive unemployment benefits (z) and either get a job offer in the private economy in the next period at rate λ, with $\lambda \in (0, 1)$, or if no job offer is available, the agent can choose between a job in the Job Guarantee program or remain unemployed, depending on the level of utility. The model assumes that there are not enough public jobs available at any time, δ captures the probability of obtaining a job offer from the JG. It is therefore also possible that agents remain unemployed and neither get a job offer from the public nor from the private sector.

$$V_u = z + \beta\lambda V_e + \beta(1-\lambda)[\delta \max(V_u, V_{JG}) + (1-\delta)V_u] \tag{3}$$

Rearranging these utility functions yields:

$$V_e = \frac{w + \beta q V_u}{1 - \beta(1-q)} \tag{4}$$

$$V_{JG} = \frac{w_{JG} + \beta x V_u}{1 - \beta(1-x)} \tag{5}$$

If agents choose V_{JG} over V_u, it holds $\frac{w_{JG}}{1-\beta} > V_u$[41] and in turn $\max(V_u, V_{JG}) = V_{JG}$. It can then be solved for V_u, which yields Equation 6.

$$V_u = \frac{z + \frac{w\beta\lambda}{1-\beta(1-q)} + \frac{w_{JG}\beta\delta(1-\lambda)}{1-\beta(1-x)}}{1 - \beta(1-\lambda)(1-\delta) - \frac{\lambda\beta^2 q}{1-\beta(1-q)} - \frac{\delta\beta^2(1-\lambda)x}{1-\beta(1-x)}} \tag{6}$$

In order to solve for the minimum wage paid in the JG (w_{JG}), V_u is plugged into $\frac{w_{JG}}{1-\beta} > V_u$. The resulting wage can be interpreted as the reservation wage, above which agents accept a job offer from the Job Guarantee (Cahuc et al., 2014) and equals Equation 7.

$$w_{JG} > \frac{z + \frac{\beta\lambda w}{1-\beta(1-q)}}{\frac{1}{1-\beta} - \frac{\beta^2\lambda q}{(1-\beta)(1-\beta(1-q))} - \frac{\beta^2(1-\lambda)\delta x}{(1-\beta)(1-\beta(1-x))} - \frac{\beta(1-\lambda)(1-\delta)}{1-\beta} - \frac{\beta(1-\lambda)\delta}{1-\beta(1-x)}} \tag{7}$$

5.3 Parameterization of the model

This section introduces defines a range of parameters which is then used to quantify the model. Each value is set to a monthly unit, which is utilized since wages are paid on a monthly basis. The range captures the upper and lower bound detected in the literature, whereas the base value refers to the average value.

[41] See Appendix for the derivation.

Symbol	Parameter	Range	Base value
β	discount rate	[0.996, 0.999]	0.9975
q	job separation rate in private labor market	[0.012, 0.017]	0.0145
x	job separation rate in JG	(0,0.012]	0.006
λ	job offer arrival rate from private labor market	[0.0034, 0.34]	0.1717
δ	job offer arrival rate from JG	[0.34, 1]	0.67
w	reference wage in private labor market	100	100
z	net replacement rate in unemployment	[34,78]	56

Table 4: Parameter setting

A summary of the range of values detected in the literature. The base value equals the average of the highest and the lowest value in the interval.

The monthly discount factor relies on the monthly, real interest rate. Vargas and van der Linden (2019) consider a weekly interest rate of $r = 0.001$ which yields a monthly interest rate of $r = 0.004$[42] for Germany. The paper by Cooper et al. (2017) is calibrated for Germany before the financial crisis and corresponds to an annual interest rate of $r = 0.04$. In monthly terms, this equals a rate of $r = 0.0033$.[43] After the financial crisis, interest rates where lower on average, in 2020 the annual interest rate was equal to $r = 0.001$ in Germany,[44] which corresponds to a monthly rate of $r = 0.00008$. Thus, the monthly rate varies from 0.00008 to 0.004. This results in the discount factor[45] ranging from 0.996 to 0.999.

The job separation rate is the probability of loosing a job here on a monthly basis. Vargas and van der Linden (2019) define a weekly job separation rate for Germany equal to 0.00443 which delivers a monthly rate of 0.01772.[46] Faberman et al. (2017) set a monthly separation rate of 0.015 using US data. Ljungqvist and Sargent (1995) set the weekly separation rate to 0.003 for Sweden, corresponding to 0.012 on a monthly basis. The range thus lies between 0.012 and 0.017.

The job offer arrival rate corresponds to the probability of getting at least one job offer within a defined period. In Frijters and van der Klaauw (2006) and Blömer et al. (2018) this rate is dependent on the duration of unemployment. Using data from the German Socio-Economic Panel, the monthly duration-dependent results from Frijters and van der Klaauw (2006) vary from 0.34 after three months of unemployment up to 0.27 after six months and then decrease again with the lowest value being 0.0034 after 21 months. In Caliendo, Cobb-Clark, et al. (2015) the rate is strictly positive and decreasing in the duration of unemployment. Using data from the European Community Household Panel, Addison et al. (2004) also find a declining rate

[42] $r_{monthly}/4 = r_{weekly}$
[43] $r_{annual}/12 = r_{monthly}$
[44] https://de.statista.com/statistik/daten/studie/202295/, last visited on 24/10/2021
[45] $\beta = \frac{1}{1+r}$
[46] $q_{monthly}/4 = q_{weekly}$

over the spell of unemployment. Faberman et al. (2017) differentiate between unemployed and employed agents: for the unemployed they model a probability of getting at least one job offer over the last four weeks of 0.047 with endogenous search effort, using the Survey of Consumer Expectations conducted by the Federal Reserve Bank New York. This variation in arrival rates can also be utilized for the model in this work. As transition from JG to regular employment is only possible after a period of unemployment, it is likely that people who participated in the JG increased their likelihood of finding a job in the private labor market. The range of this parameter can thus be interpreted in a way as it differs for people that had participated in the JG before and those that did not enter the JG in the past. Due to this high variation in values detected in the literature, a robustness check when varying this parameter is of high importance. For the model, a range between 0.0034 and 0.34 is determined.

The wage paid in the private labor market (w) is normalized to 100, similar to Vargas and van der Linden (2019). This normalization of the wage is useful since the wage paid in the Job Guarantee can then be derived relatively to the wage paid in regular employment. When considering relative terms, it can be avoided to make use of a wage distribution and making prior assumptions on the position of the agent in the wage distribution before the unemployment spell. As such, the derived wage in the model can be transmitted to all agents in the labor force.

The unemployment benefits (z) are being measured proportionally to private labor market wages. This follows the same logic as with the normalized wage. Using relative terms for this parameters makes it possible to draw conclusions on the agent, no matter where she is located in the wage distribution. As presented in section 4.2, unemployment insurance benefits is income-dependent in the first 12 months of unemployment, for longer periods, a lump-sum transfer is paid. To come up with a reliable estimate for Germany, the net replacement rate in unemployment published by the OECD is used. The variable refers to "the ratio of net household income during a selected month of the unemployment spell to the net household income before the job loss" and is published for every OECD country from 2001 onward.[47] The indicator is defined based on the previous in-work earnings,[48] the length of the unemployment spell in months[49] and whether the agent is single and with or without children. Notably, the indicator varies from 78% net replacement rate at minimum wage and 2 months unemployment spell to 34% replacement rate for the average wage and 24 months of unemployment for a single person without children.

Parameters that have not been estimated in the literature due to the novelty of the study design are the job offer arrival rate for JG-jobs (δ) and the corresponding job separation rate

[47] https://stats.oecd.org/Index.aspx?DataSetCode=NRR#, last visited on 24/10/2021
[48] which can be set to average, 67% of average and the minimum wage
[49] ranging from 1 to 60 months

(x). This work argues that the job offer arrival rate from the JG can not be lower than for unemployed to receive a regular job offer. Therefore, the upper bound of the job offer arrival rate in regular employment is used as a lower bound for the JG as well, which results in [0.34, 1]. The upper bound is set to one, which corresponds to a scenario where a job offer from the JG is available for anyone willing to work at any time. The reason for values lower than one are the unavailability of places within existing programs or difficulties in placements.

Jobs in the Job Guarantee can end due to expiring of programs or due to disregard of rules of the participants. Still, a JG would be less risky than regular employment, as jobs do not depend on economic conditions but are guaranteed by the state. In the most risky scenario, the job destruction rate may equal the rate in private employment;[50] in the *guaranteed* scenario jobs do not get destroyed and the rate converges to zero. Therefore, the interval of plausible values for the job destruction rate in the JG is set to (0, 0.012].

Using these parameters, as summarized in table 4, the derived reservation wage lays at around 96.035 for the base values.

$$w_{JG} > \frac{z + \frac{\beta\lambda w}{1-\beta(1-q)}}{\frac{1}{1-\beta} - \frac{\beta^2\lambda q}{(1-\beta)(1-\beta(1-q))} - \frac{\beta^2(1-\lambda)\delta x}{(1-\beta)(1-\beta(1-x))} - \frac{\beta(1-\lambda)(1-\delta)}{1-\beta} - \frac{\beta(1-\lambda)\delta}{1-\beta(1-x)}} \approx 96.035 \tag{8}$$

5.3.1 Interpreting results

In the model with the base values, the derived reservation wage of 96.035 can be interpreted as follows: unemployed agents can choose between unemployment and entering the Job Guarantee in the next period. Giving up the state of unemployment for the JG comes with a cost, due to the option of finding regular employment in the state of unemployment at the job offer arrival rate λ. When entering the JG, agents can only return to regular employment after a period of unemployment. Additionally, agents earn unemployment benefits in case of unemployment (z), which valorizes this labor market state. Therefore, not every unemployed directly changes into the JG. When being employed in the regular sector, individuals earn wage w which is normalized to 100 in this work. In the condition for w_{JG}, w occurs, as agents turning from unemployed to JG participants give up the chance to earn w in the next period, which increases the reservation wage for the JG. Analogously with the unemployment benefits. Following the model and the parameters chosen, the reservation wage refers to 96.035% of the wage earned in the private sector. Agents accept a lower wage than in the private labor market as the JG in this model was defined as a mode of employment at higher job offer arrival rate and lower job separation rate, which compensates for the lower wage.

[50] Here, the lower bound value is used, as $q = x + \alpha$ was introduced in section 5.

The sensitivity tests shows, that the discount factor (β), the job destruction rate (q) in the private sector, the job offer arrival rate of jobs in the private sector (λ) as well as the unemployment benefits (z) do change the reservation wage. Considering the interval size chosen based on the literature reviewing process, the biggest impact follows from changes in the job offer arrival rate in the private sector (λ), as well as from the unemployment benefits (z). The range of reservation wage derived is [63.331, 98.017]. Important to note is that the lower bound of the interval is an outlier which can be traced back to the size of the interval of λ.

Varied variable (c.p.)	Base value	Lower Bound	Upper Bound	Δ
β	96.035	95.717	96.357	0.64
q	96.035	96.572	95.511	-1.061
λ	96.035	63.331	97.904	34.573
x	96.035	96.035	96.035	0
δ	96.035	96.035	96.035	0
z	96.035	94.052	98.017	3.965

Table 5: Parameter shocking

The derived values display reservation wages in currency units, relative to a wage of 100 which is paid in the private sector. Lower, upper and base values follow from table 4. For each of these parameters eq. (7) is solved. Δ refers to the difference in reservation wage for the lower and upper bound value.

5.4 Sensitivity Analysis

A closer look at how the different factors influence the model result allows to draw conclusions on what factors influence the reservation wage.

Firstly, a higher discount factor corresponds to a higher reservation wage for the JG. The higher agents discount their future wages, the more they need to be compensated for giving up their unemployment status. In particular, the influence from β on the result is only minor. This is due to the small range of the parameter detected in the literature on the one hand, as well as the discount factor being equally present in all utility functions.

Secondly, an increase in the job destruction rate in the private labor market reduces the reservation wage: the more likely it is to loose a job in regular employment, the lower the wage that agents demand in the JG. In turn this also allows to model different labor market states in the model. The better the regular labor market conditions are, the less likely it is that people loose their job and hence this translates into a higher reservation wage for the JG. Overall, varying the parameter q did result in a range of results of around one, which is small and can be traced back to the small differences in parameters detected in the literature.

Thirdly, the job offer arrival rate causes a large variation in results. Again, this parameters is able to capture labor market conditions within the model: the higher λ, the more likely it

is for an unemployed person to receive a job offer. In turn, this causes the reservation wage to increase. Following the model this also shows how a JG appeals less interesting in times when regular labor market conditions are good. The strong variation in results is also caused by the range of parameters in the literature. The upper bound is one hundred times the lower bound, which signalizes how there is much uncertainty about this parameter. It is therefore crucial for further studies to come up with a reliable estimate for the German labor market. Additionally, this parameter is a drawback of the model as people in unemployment face the same λ as people that had just left the JG and only enter the state of unemployment due to a short transition period before entering a regular job. The range of parameters could also be interpreted as people with a JG background would face a higher probability of receiving a job offer than those who simply stayed unemployed over a longer period. This simplification of parameter displays a weakness of the model and future research could differentiate the job offer arrival rate conditional on having participated in the JG.

Fourthly, the job destruction rate in the JG x did not yield any differences. This result is surprising. In the Appendix this work presents model modifications and shows how the wage condition change when differentiating between job destruction rates in the two employment relations. The resulting conditions differ and consequently, a change in reservation wage was expected. It would have been plausible that a higher probability of loosing the JG job resulted in a higher reservation wage as compared to vice versa in regular employment. It turns out that the change in results is too minor and that introducing as well as varying x does not affect the result.

Fifthly, and similarly to x, the job offer arrival rate of jobs from the JG, δ, does not influence the outcome. Depending on the available amount of places and the likelihood of an applicant for the JG to have a fitting skill profile for available jobs, a change in δ could be caused. One would have expected that the more scarce the JG jobs, the lower the reservation wage in case the applicant would receive an offer.

Lastly, the role of the unemployment benefits in determining the reservation wage is crucial. This link is straightforward, as accepting a JG job results in giving up the unemployment benefits. The parameter occurs in the denominator solely and hence an increase is directly linked to an increase in w_{JG}. The higher z, the higher the compensation that agents demand from the JG. As unemployment benefits decrease over time, one can conclude that a JG is especially appealing for long-term unemployed. A direct policy implication would be that the government could use this variable in order to steer the demand for the JG. If the goal was to transfer unemployed into the JG as early as possible within their unemployment spell in order to prevent skill loss, the JG would have to be designed more attractively, i.e., create a larger

gap between JG wages and unemployment benefits, for people to accept at an early state of unemployment.

It is important to mention that the wedge caused by varying the parameter can not be directly traced back to their importance in determining the reservation wage. Further research is needed to pin down parameters more precisely and estimate country- and sector- specific parameters. Following this step, it would then be possible to trace back the influence in parameter changes one by one.

5.5 Introducing non-monetary benefits

The results suggest that the wage paid in the JG, above which agents prefer the JG over unemployment, is relatively high and does not deviate a lot from the wage in the private labor market apart from the scenario with a very low job offer arrival rate in the private sector. This is due to the fact that the model simplified the JG employment to an employment relation with lower job destruction rate and a higher probability of getting a job offer out of unemployment as from the regular job market. These two factors lower the wage demanded as compared to regular employment. However, the small difference in the derived reservation wage as compared to the private labor market wage might not be transferable to an economy with Job Guarantee. As outlined in this work, the JG contains benefits such as on-the-job training and social inclusion through the job which puts additional value on the JG employment. These benefits are not considered in the model by now. To overcome this limitation, non-monetary benefits from employment are introduced as an extension.

There is an unambiguous relationship between unemployment and well being in the literature. An extensive overview was given in section 3 and section 4.1.4. These previous research findings underline the necessity of incorporating benefits from work. This benefit is modelled by $\eta > 0$ from now on. It changes the utility function in regular employment and in the JG to the following, whereas the utility in unemployment remains unchanged.

$$V_e = (w + \eta) + \beta(1 - q)V_e + \beta q V_u \tag{9}$$

$$V_{JG} = (w_{JG} + \eta) + \beta(1 - x)V_{JG} + \beta x V_u \tag{10}$$

$$V_u = z + \beta\lambda V_e + \beta(1 - \lambda)[\delta \max(V_u, V_{JG}) + (1 - \delta)V_u] \tag{11}$$

Analogously, as introduced in the model without non-monetary benefits, the condition above for which agents prefer the JG over unemployment needs to be defined. Now, $\frac{w_{JG}+\eta}{1-\beta} > V_u$ needs to hold for $max(V_u, V_{JG}) = V_{JG}$ to be true, which delivers Equation 12.

$$V_u = \frac{z + \frac{(w+\eta)\beta\lambda}{1-\beta(1-q)} + \frac{(w_{JG}+\eta)\beta\delta(1-\lambda)}{1-\beta(1-x)}}{1 - \beta(1-\lambda)(1-\delta) - \frac{\lambda\beta^2 q}{1-\beta(1-q)} - \frac{\delta\beta^2(1-\lambda)x}{1-\beta(1-x)}} \tag{12}$$

Again, solving for the reservation wage w_{JG}, this results in:

$$w_{JG} > \frac{z + \frac{\beta\lambda(w+\eta)}{1-\beta(1-q)}}{\frac{1}{1-\beta} - \frac{\beta^2\lambda q}{(1-\beta)(1-\beta(1-q))} - \frac{\beta^2(1-\lambda)\delta x}{(1-\beta)(1-\beta(1-x))} - \frac{\beta(1-\lambda)(1-\delta)}{1-\beta} - \frac{\beta(1-\lambda)\delta}{1-\beta(1-x)}} - \eta = 96.035 - 0.09\eta \tag{13}$$

As compared to the reservation wage derived in Equation 7, the new parameter η decrease the reservation wage to Equation 13. Plugging in the base values as summarized in Table 4 the above wage condition is derived.

The reservation wage as derived in section 5 is being reduced by the utility from work η ($\eta > 0$) by a factor of 0.09. This negative relationship indicates that unemployed are more likely to accept a JG offer at a lower wage the higher the benefit from working. Vice versa, the lower the non-monetary utility from the JG, the higher the wage needed to pay for unemployed to accept the offer. Until recently, there is no estimate of this factor in the literature and further research could shed light on the quantification. To be able to use the model results, these factors needed to be expressed relatively to the wage w.

5.6 Discussion of the results

Despite the simplicity of the model, the results can enter the debate surrounding the Job Guarantee. Using a one-sided job search model, the model deduces different utility functions that incorporate the outside-option of state employment. The results lay at around 96.035 and are only marginally smaller compared to the regular employment relation where the agent obtained a wage (w) which was set to 100. This appears logical as the model broke down the Job Guarantee to a mode of employment with a different wage, different job offer arrival rate and a different job separation rate. Thus, the only advantage of a Job Guarantee as modelled in the section 5 comes from the more secure employment relation and the more frequent job offer which in turn reduces the demanded wage. For an agent to choose the Job Guarantee over unemployment she must obtain a wage that is 96.04% of the wage obtained in regular employment before the period of unemployment.

The extension of the model with regards to the definition of a Job Guarantee in the corresponding utility function followed. Including the positive value from work, the social inclusion and on-the-job training and others, increases the utility derived from a Job Guarantee. In this modification, the derived reservation wage is smaller, as non-monetary values increase the benefits from a public employment relationship. The results show how the derived wage of 96.035 is being reduced by η. This implies that the design of the JG and its success in offering on-the-job training as well as giving participants the perception of being needed reduces the wage that need to be paid in the program in order to make people participate.

Overall, the model allows to draw conclusions about possible participants. Important to mention is that the model restricts the group of eligible persons to the group of unemployed, but not further.[51] As a result, having defined the pay and knowing the pre-unemployment wage, the model allows to draw conclusions on the group of persons that would accept the public job offer.

Further research should calibrate the parameters more carefully, especially those for the Job Guarantee sector, based on German labor market data. The model enables to quantify the effect from economic crisis on the derived wage. An example is the Covid-19 pandemic with high unemployment rates which could increase the job separation rates in the private sector, while leaving the separation rate at state employment unchanged. The option of comparing the characteristics of the private with the public labor market is a key feature of the model and enables further researcher to model the required wage payments for the Job Guarantee.

5.7 Limitations of the model

Clearly, the model has some major drawbacks. On the one hand, job offers from the private labor market are always being accepted without considering the wage level, whereas from the Job Guarantee side, the reservation wage is being considered as deciding factor. Another problem arises from the fact that people who have participated in the JG face the same job offer arrival rate for regular jobs as people that remained "only" in unemployment. Enabling transition from JG to private employment would be an extension of the model in order to better quantify the increase in likelihood of finding a job in the regular labor market from participating in the JG. With no doubt, the implications from the model are also limited due to the fact that decision-making parameters are not considered such as search effort or the duration of unemployment. Furthermore, higher efficiency of job agencies might positively influence the job offer arrival rates for both sectors and could play a role in the model as well. Next, jobs in the model do not differ in terms of skills required and type of jobs such as working hours or conditions.

[51] As introduced before, a Job Guarantee is often restricted to the group of long-term unemployed in the literature.

6 Conclusion

This thesis used a Job Search model to asses a Job Guarantee, focusing on the case for Germany. In order to come up with a wage above which agents prefer the Job Guarantee over unemployment, the one-sided Job Search model from Williamson (1999) was modified. The derived wage lays at 96.035 currency units. This implies that compared to regular employment, where a wage of 100 is paid, the additional security and the higher job offer arrival rates reduces the wage demanded to accept the job by around 3.965. The introduction of non-monetary benefits from working reduces the derived reservation wage, implying that appreciation of being employed makes unemployed accepting a JG offer at a lower wage.

Overall, this work contributed to the debate surrounding a Job Guarantee from a theoretical approach. The idea of a Job Guarantee is not a new concept in the literature (see for example Mitchell, 1998), the use of theoretical models, however, is still rare. Developments in this field of research could help to better define the optimal framework, paving the way for a success of the Job Guarantee.

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Appendix

Solving the model

$$V_e = w + \beta(1-q)V_e + \beta q V_u$$

$$V_e = \frac{w + \beta q V_u}{1 - \beta(1-q)}$$

$$V_{JG} = w_{JG} + \beta(1-x)V_{JG} + \beta x V_u$$

$$V_{JG} = \frac{w_{JG} + \beta x V_u}{1 - \beta(1-x)}$$

$$V_u = z + \beta\lambda V_e + \beta(1-\lambda)[\delta \max(V_u, V_{JG}) + (1-\delta)V_u]$$

In order to simplify V_u it is required to solve $\max(V_u, V_{JG})$. This expression is equal to V_{JG} if $V_u > V_{JG}$ holds. Solving the following expression yields the condition below.

$$V_u > \frac{w_{JG} + \beta q V_u}{1 - \beta(1-x)}$$

This is equal to $\frac{w_{JG}}{1-\beta} > V_u$. Next, V_u can be expressed in terms of parameters only.

$$V_u = \frac{z + \frac{w\beta\lambda}{1-\beta(1-q)} + \frac{w_{JG}\beta\delta(1-\lambda)}{1-\beta(1-x)}}{1 - \beta(1-\lambda)(1-\delta) - \frac{\lambda\beta^2 q}{1-\beta(1-q)} - \frac{\delta\beta^2(1-\lambda)x}{1-\beta(1-x)}}$$

Plugging this condition into $\frac{w_{JG}}{1-\beta} > V_u$ enables to solve for w_{JG}.