Celebrating 150 Years of Analyzing Fertility Trends in Germany

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Summary

Ever since the very beginning of the *Journal of Economics and Statistics* population economics has featured prominently in the *Journal*. Fertility naturally plays an important role in population economics. However, the level of German fertility has decreased significantly from the 1900s. The paper documents and analyzes the long-term development trends. We identify three different explanatory approaches for the decline in fertility according to which the various articles of the *Journal* related to this area are categorized. The paper also investigates fertility studies published by the *Journal* since the beginning. It points out that several articles anticipated subsequent research directions in the area of population economics at an early stage. In addition, significant contributions were made to improve and develop existing knowledge and understanding. Thus, the *Journal* has helped to expand the research area of population economics.

1 Introduction

"People will always have babies" was what German chancellor Konrad Adenauer said in 1957 when he defended the reform of the German pension system to a pay-as-you-go scheme. With that judgment he destroyed the arguments of those who doubted that the system – based on the so-called generation contract – would last forever. In the same year the total fertility rate in West Germany was 2.36 children per woman, but by 2010 that rate had fallen to only 1.39 (Destatis 2012b). While Adenauer did not consider this a problem, demography has proven him wrong. This is why a proper understanding of population economics is so important.

Since its beginning in 1863 the *Journal of Economics and Statistics*, founded by Bruno Hildebrand (1812–1878), has taken this research topic comprehensively into account. This article seeks to take stock of the development of population economics focusing on the discussion on fertility, in particular with regard to early articles of the *Journal*. To do this, we aim to examine both the explanatory variables and the development of the understanding of the population process after what Walt Rostow (1969: 4ff.) refers to as the take-off of industrialization in Germany which took place between 1850 and 1873.

Fertility and mortality undoubtedly constitute the essential growth components of the population development. In the paper we focus primarily on the development of fertility in Germany without neglecting to investigate the mortality rates.

The outline of the paper is as follows. The next section provides an overview of the time-series and trends of fertility in the long run. The analysis includes a discussion of the recent situation in Germany. Thereafter, we present and discuss the respective articles of the *Journal* in chronological order taking into account the three explanatory approaches or theories. The paper then ends with conclusions.

2   The long-term demographic development

This section analyzes the economic factors influencing the changes of fertility over time. Many European countries including Germany experienced a phase of demographic transition from 1800 to 1900. This phenomenon is usually defined as the transition process from (both) high to (both) low mortality and birth rates (Thompson 1929; Notestein 1945). This transition usually starts with a decreasing mortality rate which after some time is followed by a decline in the fertility rate.

In order to study the long time-series, we present the development of the total fertility rate from 1870 to 2010. As a reference, we also measure and present the replacement rate over time which is the level of fertility required to ensure a constant population. In this calculation we do not consider migration. As Figure 1 shows, about 40 years after the beginning of the *Journal* in 1863 the total fertility rate started to decrease significantly. The first drastic low occurred during World War I (1914 – 1918). Afterwards, the total fertility rate recovered again peaking around 1920 at a little less than 3.5 but reached another low only a few years later during the Great Depression. Thereafter, the rate recovered again quickly before diminishing sharply with the beginning of World War II to a new record low by the end of the war. After a rise in the birth rate between 1950 and 1960 the rate increased strikingly before reaching a new low in the early 1970s and remained relatively stable up to 2010.

Figure 1 shows that the fluctuations around the trend diminished over time. Since the middle of the 1970s the course of the total fertility rate seems to have remained relatively stable. Shortly after the first publication of the *Journal* the average life expectancy at birth was approximately 34 years for men and 37 for women (Ehmer 2004: 34), whereas a man born in 2008/2010 is likely to live for about 77.5 years and a woman 82.6 (Destatis 2012a). In 2010 the total fertility rate in Germany was roughly 1.4 on average (Destatis 2012b). Moreover, since 1983 the rate has remained below 1.5 children per woman (OECD 2011). During the first years of the *Journal*, the average total fertility rate after the formal reunification of Germany (*Reichseinigung*) in 1871 was roughly 4.7 and thus significantly higher compared to 2010.

3   The contributions of the *Journal* to population economics

During our investigations we identified three different explanatory approaches for the decline in fertility according to which we will categorize the various articles of the *Journal* related to this research area. Additional to the three explanatory approaches identified in the *Journal*, there are several other theories and contributions in the area of the economic theory of fertility. To provide an overview, the main thoughts will be mentioned at this point. These include, for example, contributions to the infant mortality
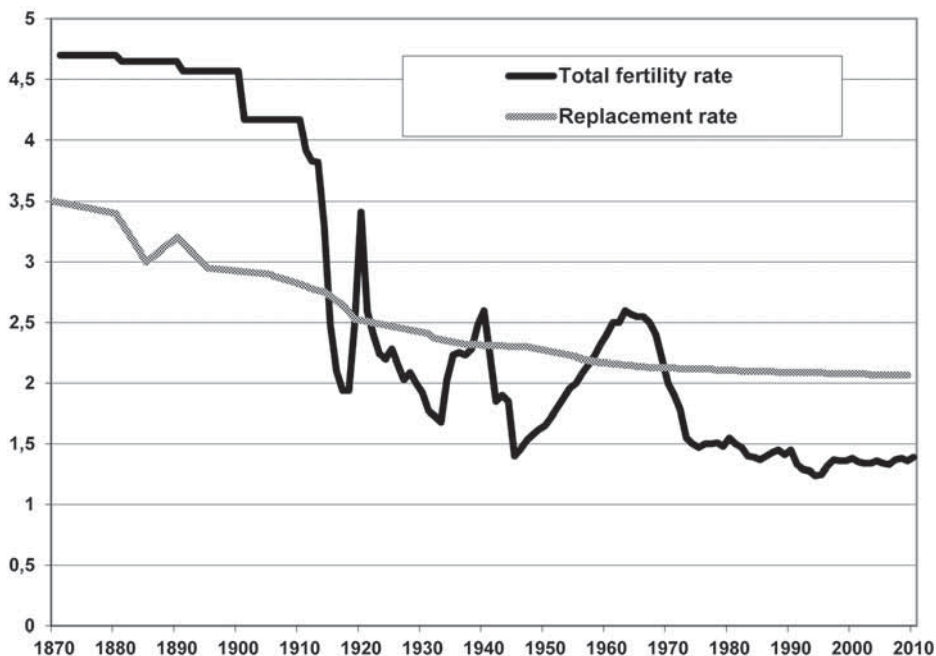
Source: Bundesinstitut für Bevölkerungsforschung (2011).

Note: For several years no data were available. To create a long time-series, intermediate years were estimated.

Figure 1 The long decline of the German total fertility rate from 1871–2010

rate of (Rosenzweig/Schultz 1982). Thereafter, families desire to have a certain number of children. An increasing income goes in line with a decrease in the death rate and an incline as regards the probability of surviving of children. Consequently, fewer births are sought by the individuals. This is shown by Army and May (1968) within their article about the desired number of children in India within the series Population Studies. A similar argument is used, inter alia, by Repetto (1972) and Leibenstein (1974: 464).

Furthermore, the socioeconomic status is suggested to be another sociological and economic theory of fertility. Depending on the different status, people tend to have different preferences concerning children or material goods. According to this theory, the higher the social status is the stronger the preferences for material goods are pronounced. In this context, it is important to mention the contributions made by Easterlin (1969) and Freedman (1963). Similarly, some authors emphasize (Easterlin 1978; Encarnación 1973) the existence of so-called thresholds, both in terms of income and education, according to which the inverse relations between fertility, income or rather education can be observed. Also, demographic researchers (Freedman 1963) argue that changes in norms and institutions, through e. g. a process of modernization, have an influence on the size of the family. This might encompass group membership such as a peer group. Easterlin (1978) develops an idea of Duesenberry (1960), hereafter an individual seeks to maintain a certain target standard of living and excessive numbers of children worked against this (Leibenstein 1974: 465).

Table 1 Relation between population and food growth according to Malthus

	Annual intervals								
	0	25	50	75	100	125	150	175	200
Total population	1	2	4	8	16	32	64	128	256
Means of sustenance	1	2	3	4	5	6	7	8	9

Source: Esenwein-Rothe (1978: 58).

The first approach was provided by the founder of population economics, Thomas R. Malthus (1766–1834). The English economist was rather concerned by the near future of the population. His 'Essay on the Principle of Population' (Malthus 1798) was one of the first on population economics which received a great deal of attention.

Malthus assumed that the total number of the population would grow in a geometric series which meant the number would double every 25 years. On the other hand, the means of sustenance could only be enhanced by arithmetical progression (see Table 1). The population would thus grow more rapidly than food production. Further growth in the population could not be supported by the food supply and would lead to impoverishment or death from starvation (Esenwein-Rothe 1978: 58). Thus, the fear of overpopulation and food scarcity, introduced by Malthus, constitutes the first explanatory approach in the area of population economics.

The second approach was developed by Lujo Brentano, Gary Becker, and Jacob Mincer (Brentano 1909; Becker 1960; Mincer 1963). This approach is closely related to the rational choice theory dealing with trade-offs between goods and opportunity costs. This theory is based on utility maximization and takes into account in various forms the costs of raising children, the value of time, the costs for education, and the participation of women in the labor market as well as the impact of uncertainties on the labor market. It creates a potential for a non-linear budget constraint that generates an impact of income on fertility that switches from positive to negative with rising income. Rising living expenses and female wages are negatively related with fertility.

The third explanatory approach is circumscribed by self-regulation. Ronald Freedman (1975) offers the explanation that fertility reacted to the increase of child survival in a more or less homoeostatic way. This means that self-regulation played a strong role during 1875 and 1960. According to this approach, the phenomenon of the decline in fertility can be attributed to a regulatory circuit. Hence, fertility adapts to a decline in the child mortality rate and a natural number of children is reached. In turn, when child mortality is high, more children are raised. This approach is not linked with the rational choice theory, but it rather contains a leveling off in terms of fertility.

Ever since the very beginning of classical economics, population problems have played an important role in this emerging research area. At the time of mercantilism, which represented the dominant economic doctrine across Europe from the 16th to the 18th century, people assumed that the strength of a country largely relied on the number of soldiers. To obtain a large army, a country had to strive for a large population. The German pastor, statistician, and demographer Johann P. Süßmilch (1707–1767) believed population growth to be the 'happiness of a country'. The prosperity of a nation would, according to the mercantilist conception, benefit enormously from an increasing population by stimulating social and economic development. It was assumed that demographic growth would contribute to consolidating the position of the ruling class (Overbeek 1974: 30).

In order to paint a realistic picture of the past, it should be noted that at the beginning of the 19th century most women in Germany died at an early age. Although lifespans were shorter, there was an average of five births per married woman. However, during that time we have to differentiate between the number of births and the number of children. In the middle of the 19th century only half of all children born in Germany reached adulthood. Not until the course of the 20th century did the number of births and the number of children start to converge. It was at the turn of this century when generations of women stood on the verge of a decline in the fertility rate. Thereafter, the average number of children per woman decreased dramatically from nearly 5 to around 2 (Ehmer 2004: 34-44). With the growing acceptance of how germs spread disease, more emphasis was put on hygiene which constrained the spread of diseases and contributed to a rise in life expectancy. Factors contributing to lower mortality rates amongst children included the declining price of food relative to wages and better quality and diversity of food. This was especially true of food bought from urban markets. Moreover, better housing together with the expansion of welfare systems greatly improved the medical and nutritional conditions for the vast majority of people (Schultz 2009).

At the end of the 19th century Reich Chancellor Otto von Bismarck gradually introduced social legislation in Germany starting with accident insurance in 1884. This insurance was created in order to protect workers against basic risks. The emergence of the social security system at the end of the 19th century established a welfare system which began to expand in the following years and provided a safety net from risks such as accidents, poverty, aging, and illness (Kendzia 2010a). However, this was not the first legal provision of this kind. The "Regulativ über die Beschäftigung jugendlicher Arbeiter in Fabriken" was one the first legal measures which protected workers and came into force in 1839. The result was a major step towards a ban in Prussia on child labor (aged younger than 10). Several other factors also played a role, including the decreasing demand for unskilled workers as a consequence of rapid technical progress and a stronger enforcement of the compulsory school attendance which had existed throughout Prussia since 1717 (Kendzia/Pierenkemper 2010). Through the stronger enforcement of the compulsory school attendance, fewer individuals were joining the workforce.

This, in turn, resulted in a relaxed situation in the labor market which went hand in hand with a rise in living standards across Germany (Zimmermann 1988). Most parts of Europe during the 19th century were shaped by a new and irreversible process which had begun and would lead to the single most sectoral structural change in the economic landscape: industrialization. The share of people working in agriculture decreased, and more and more people began to work in new industries such as mining and steel manufacturing or later in the chemical and electrical industries, which soon started to gain international reputation.

4 The first years of the *Journal* until the seizure of power by the National Socialists

In the first years of the *Journal* the economist and statistician Hans von Scheel (1839–1901), an assistant of Hildebrand at the statistical office in Jena, showed that the wealth and growth of the population would be closely related to the quantity of available resources, such as means of sustenance (e.g. food). According to Scheel, it would be the task of statistics to recognize and verify the degree of dependence the population had on comestible goods. He referred to an early study carried out by the French demographer

Louis Messance (1734 – 1796) on the relation between grain prices and changes in the mortality rate.[1] Messance (1767) had shown a time-series including the average grain prices and compared those with the mortality rate over time. He found that the mortality rate was lower when grain was cheaper. After presenting further studies on this issue he concluded that there was little point investigating the manner further because showing that grain prices influence the mortality rate could be displayed by following simple common sense – without any help from statistics. Scheel then investigated the prices of grain, potatoes, and meat in the small duchy of Altenburg from 1835 to 1864. However, since the consumption of meat – relative to grain or potatoes – was small for large parts of the population, he decided to concentrate on the development of the price of grain and compared its course with the number of births. He showed a reverse development of the price of grain and fertility, i. e. that a high price for grain resulted in lower births in following years (Scheel 1866: 176ff.).

A few years after Scheel's analysis of the price of grain and its close relation to the mortality rate the economist, and later rector of the University of Strasbourg, Georg Friedrich Knapp (1842 – 1926) investigated the mortality rate for the city of Leipzig from 1751 to 1870. He found that the mortality rate of children 12 months and younger was 0.223, which meant that from 1000 children approximately 223 had died during their first year. By contrast, this rate was 0.144 for children between 1 and 10. Knapp argued that compared to earlier years both rates had already decreased and concluded that this could in particular be attributed to an improvement in health care, better hospitals, an approved type of construction of cities, and better household furnishings (Knapp 1873a).

Thus, in the literature there already existed agreement over improvements in terms of urban public health infrastructure leading to increased living standards. For instance, investments and regulations concerning water supply and sanitation had had a huge impact on the quality of life. The growing standard of living can be interpreted as a consequence of a general process that had been occurring during the 19th century: urbanization. It describes the migration of large parts of the population from the countryside to steadily growing cities. As a result, more and more of those agglomerations attracted an increasing number of workers. Around 1913 the general employment in industries in Germany exceeded the employment in agriculture for the first time (Kendzia 2010a: 6).

The process of urbanization was also documented by several authors of the *Journal* (e. g. N. N. 1871: 135ff.; Seutemann 1906: 88). Scheel (1874: 1ff.) indicated that the urbanization went hand in hand with an increasing rate of women's employment. Moreover, he denoted that they were becoming less active in the field of domestic work. As Scheel put it, women were being driven out of their traditional sphere of work. A later article examined the further growth of the population and in particular considered the high fertility rate in industrial areas which was attributed to the large number of children working class families had (Rohr 1891: 118ff.).

Prinzing (1899: 581) gave a truly comprehensive account of child mortality across Germany. He analyzed the development of the child mortality rate within European countries over time. According to him, favorable economic conditions would result in higher fertility rates, but he failed to substantiate this. Prinzing's elaborations and assumptions

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[1] Recherches sur la population des genéralités d'Auvergne, de Lyon, de Rouen et de quelques province et villes du royaume avec des reflexions sur la valeur du bled tant en France qu'en Angleterre depuis 1674 jusqu'en 1764 par M. Messance (Louis Messance), Paris 1767.

were closely related to Malthusian concerns and can thus be attributed to the first category of our explanatory approach. Similar to Malthus, his assumptions would have led to an enormous rise in population by an increasing national income per capita. However, he was proved to be wrong shortly after the turn of the 20th century.

A later author of articles in the *Journal* contributing to the discussion on the development of fertility, Karl Seutemann (1907: 293ff.), observed a decline in the fertility rate between 1890 and 1905. He denoted that a decline in the mortality rate would lead to two growing parts of the population: on the one hand the non-fertile cohort, such as the very young, and on the other hand the old. He went on later to discard this notion. He pointed out that a certain mechanism of self-regulation would imply decreasing fertility rates. He concluded that a decline of the fertility rate was mostly associated with food shortages resulting from higher life expectancies as well as the decreasing mortality rate. Consequently, people would raise fewer children than in the past (Seutemann 1907: 293ff.). With this, Seutemann (1907) relates to the first category of the three identified explanatory approaches.

The German economist and social reformer Lujo Brentano (1844–1931) found a direct and negative correlation between welfare and matrimonial fertility. In addition to Malthus, who argued that sexual abstinence, vice, and misery all impeded fertility, Brentano (1909) suggested that physiological reasons as well as the separation between sexual drive and reproductive behavior would also affect fertility. However, we will not elaborate on the physiological aspect in this paper since we argue that the decisive factors influencing fertility have always been primarily of an economic nature. According to Brentano (1909), the decline of the willingness to procreate was due to different activities from which the household could choose and to the enhanced quality of child care. The concept of choice between different activities by respecting the utility maximization, the time costs of bringing up children as well as the quality of life for children can all be interpreted as an important step into the area of modern population economics (Zimmermann 1989: 474ff.). Since Brentano (1909) stresses household choice, he should be considered as a representative of the rational choice theory and belongs to the second category of the explanatory approaches.

In 1913 Henriette Fürth (1861–1938), who later became the first woman to join the German Society for Sociology, noted in the *Journal* that a decline in fertility would constitute a major social problem and indicated that with increasing costs of the standard of living – and growing expectations as a result – fewer children would be born. With regard to higher fertility within working-class families compared to other social classes, she argued that a rise of food prices would also contribute to higher costs of living. Since fertility rates had decreased among both the poor and the rich, she also traced the decline back to more sophisticated individual, cultural demands (Fürth 1913: 721ff.). However, Fürth follows the second explanatory approach by exhibiting higher demands which would lead to higher costs to keep the standard of living. With that, not only Seutemann (1907) but also Fürth (1913) had already identified key elements of the quality-quantity trade-off which is later further discussed by Becker. Interestingly, Fürth (1913) showed that the administration was deliberately not spreading contraception among the vast majority of the population but instead distributing it solely to members of the German navy. The government wanted unrestrained population growth in order to strengthen military power (Fürth 1913: 747ff.). A possible reason why sailors are given contraception is to protect its sailors from possible diseases. However, this is not speculated by Fürth.

During World War I fertility declined, but Fürth did not consider reasons for this phenomenon in her article (Guradze 1916: 550ff.). As P. Kollmann (1915: 251f.) had argued one year earlier, the only cogent reason for the further decline in fertility could be associated with the continued reduction in child mortality. If we follow his argument, then most people in society had started to anticipate the converging of the number of births and the number of children which was due to a decline in child mortality rates. Similar deliberations were shared by Karl Oldenberg (1923: 315ff.) who dealt explicitly with the connection between fertility and child mortality. Both deliberations dealing with anticipation can be seen in connection with the third explanatory approach, ,self-regulation'. In the 19th century the number of births and the number of children were divergent. Due to a decline in the mortality rate in the 20th century, those numbers converged. Self-regulation thus meant that people anticipated these changes and adapted the number of children accordingly.

Ernst Günther dealt with the issue of declining fertility and its potential impact on the unemployment rate in an article in 1931. He examined a period of around 15 to 20 years during the demographic transition. The paradox he formulated was that fewer births – and with that fewer workers – would lead to higher unemployment (Günther 1931). A later author of the Journal, Adolf Wagner, adopted this idea in his article on the 'Günther paradox'. He believed that if the dependence were to exist there would be something – in the style of the demographic transition – like demographic unemployment (Wagner 1980).

5   The *Journal* in the time of National Socialism

Following the rise to power by the National Socialists in 1933 their ideology, including the role of women as mothers and housewives, could soon be observed across society. After the Great Depression, during the early 1930s, the regime started replacing female employment with male employment and promoted female activities in the area of private households and agriculture. According to Mackenroth (1934: 205), this measure was aimed at stabilizing the wage level. As we can see from Figure 1, there was a noticeable increase in fertility. The incline of the fertility rate across Germany, despite a high participation rate of women on the labour market, was described in the *Journal* by the same author (Mackenroth: 1934: 445). Michalke (1935: 438ff.) noted that during the Great Depression the spread of female employment was due to the fact that female labor was cheaper. In the following years possible female employment was considered as a 'reserve'.

In 1936 the official office responsible for the use of female workers – *Frauenamt der Deutschen Arbeitsfront* – prepared women for their later roles as mothers and housewives rather than for the labor market (Willeke 1936: 197-208). This bears witness to the fact that research documented the impact of the ideology of National Socialism which included the role of women with care responsibilities in the household, rather than economically independent individuals.

After reaching full employment in 1936 the regime first tolerated and afterwards supported female workers. When labor shortages occurred, the interest of the National Socialist regime to promote female employment grew rapidly from 1942 on. This resulted in obligatory work for women in 1943 (Kendzia 2010b). Interestingly, in 1937 Ungern-Sternberg (1937: 471ff.) examined the development of the economic situation in parallel with fertility. He presented a theory which compared the relatively low fertility with the 'state of emergency' in which individuals found themselves. The reason for this assumed

state was that most people thought they could not afford to have children. Furthermore, in his investigation he suggested that the reason for the decline in fertility would stem from self-imposed 'artificial birth restriction'. This behavior was, according to Ungern-Sternberg, due to the intention of many people in society to sustain prosperity for the later generation. Hence, he belongs to the second category within this paper. Birth control in order to ensure a higher living standard for future generations reflects a trade-off which can be interpreted as a rational choice. His explanations are early indications of an idea which would later be described as 'fertility control' by the French demographer Louis Henry in the 1950s. Fleury and Henry (1956) stressed that fertility control would result in fewer children because households would avoid further births after a certain number of children had been reached (Coale/Watkins 1986: 9). And indeed, this argumentation again raises the importance of the formulated trade-off in a household which states that human beings should behave or act rationally. Accordingly, the strong desire for restricted births corresponded directly to the social and economic change taking place at that time (Pollack/Watkins 1993: 468ff.).

As shown above, the research on fertility trends in the *Journal* documented the developments across Germany during the time under the National Socialist regime. Only one author used the then relatively national wording 'Das deutsche Volk' for the German population and somewhat exaggerated the increasing fertility rate as achievement of the ruling regime. Its policies in view of fertility included direct financial aids aiming at increasing marriages and reducing the costs of rearing children. Moreover, the same group was supported through privileges and advancements. And lastly, the abortion law was enforced by the state (Taeuber/Taeuber 1940: 150). The German demographer Friedrich Burgdörfer (1890 – 1967), member of the then ruling party NSDAP[2] since 1937, stated referring to the increase of births during the years 1934 – 1937, 'The German mothers presented the National Socialist Reich within four years a full birth cohort better than expected' (Burgdörfer 1938: 300).[3] However, as Taeuber and Taeuber (1940) put it, 'the extent to which Germany has raised the birth rate should not be overestimated' (Taeuber/Taeuber 1940: 163). That is, the impact of the National Socialist policies on the fertility rate remains controversial in population economics. In Germany, the industrial production reached its low around the year 1932. Afterwards, the economy within the leading industrialized countries such as the United States, the United Kingdom, France, Germany, and Japan recovered noticeably. Thus, a general economic upswing across the mentioned countries took place soon after the seizure of power by the National Socialists in 1933 (Romer 1993: 21).

The wording suggests that the author could not entirely escape the then dominating national atmosphere. Nevertheless, the author described correctly that the fertility rate during that time increased, as Figure 1 shows (Ungern-Sternberg 1937: 484). However, other authors without any article in the *Journal* followed a rather dubious approach during the National Socialist regime such as Karl V. Müller (1935) investigating the core of the racial hygiene in order to create a sustainable population and race policy (Ferdinand 2006: 217). Nonetheless, it is true to say that population economics dealing with fertility in Germany did not suddenly end up in the year 1933, the seizure of power through the

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[2] The shortcut stands for the 'Nationalsozialistische Deutsche Arbeiterpartei' (National Socialist German Workers' Party).

[3] The original quote is as follows: "Die deutschen Mütter haben dem Nationalsozialistischen Reich in vier Jahren sozusagen einen vollen Geburtsjahrgang überplanmäßig geschenkt".

Table 2 Articles in the *Journal* on fertility during 1863 and 2013 (15-year period)

1863–1877	1878–1892	1893–1907	1908–1922	1923–1937	1938–1952	1953–1967	1968–1982	1983–1997	1998–2012
1	1	4	4	4	1	0	3	4	2

National Socialists. Similarly, we can state that there did not exist a 'zero hour' concerning population economics in the year 1945 and after (Gutberger 2006: 162).

In 1941 Zwiedineck-Südenhorst (1871–1957) (1941: 161ff.) noted that in previous centuries the fear of overpopulation often occurred and thus rather Malthusian concerns were shared. However, in recent years, as he observed, the opposing fear of depopulation would arise. Similarly, he reported on the then alleged demographic policy claiming at least three children per woman (Zwiedineck-Südenhorst 1941: 168). With Zwiedineck-Südenhorst the *Journal* experienced a caesura in terms of publishing articles on fertility issues. As Table 1 displays, the *Journal's* interest in population economics decreased soon after World War II. It is true to say that during this period more emphasis was generally put on theoretical developments in economics, but discussions on fertility vanished from the scene. According to Kurz, World War II and a massive increase in the fertility rate in the following years led to this standstill (Kurz 1982: 235f.).

6   The *Journal* from the post-war period to today

This changed with stagnating and later decreasing fertility rates in the beginning of the 1970s in many industrialized countries. Jacob Mincer (1922–2006) (1963) further developed the decision-making process within households by introducing two important factors. Firstly, he introduced the time costs of raising children, and secondly, he argued that the female labor force supply and the wish to have children are both part of the decision-making process within the family. In doing so, Mincer applied the concept of opportunity costs to the issue of raising children (Zimmermann 1988: 123, 1989: 469).[4] In the sequel, it was possible to predict a decline in fertility and a rise in female work participation as the outcome of joint decision making driven by a relative increase of female wages in comparison to male wages.

The next groundbreaking contribution to model the decline in fertility was Becker's attempt to model home production within the so-called quantity–quality (Q–Q) trade-off (Becker 1981/1991). This approach pointed out that the Malthusian model had missed the connection that with increasing income more and more emphasis was put on child quality. The child Q–Q trade-off between fertility and education is generally described as the choice between the quantity of children and the quality of human capital invested in each child. Becker showed that the Q–Q trade-off is closely related to income and prices as well as tastes (Becker et al. 2010). Zimmermann (1985, 1989) has shown that the complex quantity-quality approach of Becker can be replaced by simply assuming that child material expenditures ("child living expenses") are rising with the consump-

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[4]   As Zimmermann (1988, 1989) has pointed out, it was Mincer (1963) and not Becker (1960) who developed the most important elements of the neoclassical theory of fertility first before Becker (1981/1991) established and dominated the field. A full discussion of the international literature can also be found in Zimmermann (2005) which also contains a comprehensive reference list.

tion level of the parents. This child living expenses approach leads to the same conclusions concerning a negative impact of rising income on fertility.

As another representative of the rational choice theory, Ingeborg Esenwein-Rothe (1911–2002), dealt with population forecasting models and their limits in 1978. She examined the different developments concerning fertility across the world. She investigated not only the issue of overpopulation in developing countries but also the decreasing fertility and wrote of the fear of the death of an entire nation. Esenwein-Rothe (1978) also described the reasons for the increasing standard of living during industrialization by highlighting how the railway and steamships had expanded means of sustenance. At the same time the transparency of the market had improved through modern telecommunications. She spoke of a cultural change in the awareness of future generations. Fertility would go hand in hand with the increasing standard of living which meant that the size of a family would adapt to the financial and time resources of the individuals according to their social conditions and desires (Esenwein-Rothe 1978).

Meanwhile, the family of four with two parents and two children had become the dominant family structure in society. During the time when national ideas were sweeping across Germany, this dramatic decrease was heavily debated and criticized as the possible death of the nation and later, assuming an ever more dramatic scenario during the years of the National Socialist regime, the death of the German race. By World War I the total fertility rate had reached an all-time low which recovered afterwards but fell once again to a new low during the Great Depression and at the end of World War II. As Figure 1 shows, the 1950s and 1960s witnessed a baby boom with the total fertility rate rising to nearly 2.5. This can be linked with the German economic miracle which took place until the first recession after World War II in 1966 to 1967. After that period a short and dramatic decline in fertility occurred until the early 1970s when the decline stabilized. The development of the total fertility rate in West and East Germany until 1970 remained more or less the same. Only in the second half of the 1970s did the rate increase in East Germany, whereas the rate in the West remained stable at 1.4 (Ehmer 2004: 44-46).

Another contribution in the *Journal*, which was made by Adolf Wagner, concerned a book dealing with the decline in fertility (Dinkel 1985). Wagner pointed out that most people worked in agriculture prior to industrialization. During that time children were often employed as workers on the family farm (Wagner 1985: 544). Thus, child work diminished during industrialization and fewer children were born. The Malthusian concerns regarding overpopulation did not materialize in developed countries because one of his key assumptions proved to be wrong. Malthus failed to consider that technical progress would increase farming yields so greatly which meant that the increase in food supply outstripped the demand.

Furthermore, Malthus suggested a positive correlation between income and fertility (Zimmermann 1988: 121f.). Due to the implementation of a social security system, the social benefit of children decreased. At the same time, the costs of raising children increased. Matthias Bletzinger and Uwe Walz (1989) extended the theoretical model of fertility by Zimmermann (1985) to explain the empirically observable negative relationship between income and fertility. They showed that in particular the social status of the parents determines the essential inputs for the children. Olaf Hübler (1991) added that women would earn on average less than men. He dealt with the causes of gender wage discrimination and gender dependent earnings. The article did not discuss the economic factors influencing fertility, however.

Assenmacher and Wenke (1993) referred to Becker's model of the household which not only consumes but also produces. Both authors reported that the service sector has risen constantly across industrialized countries. To explain this growth they indicate the shift from home production to market production in terms of services as a consequence of increasing labor market participation by women. This trend can be described as follows: In the beginning of the 1960s the female employment rate accounted for less than 50 percent. However, the same rate increased significantly during the last 50 years and peaked in 2010 at nearly 70 percent (Statistisches Bundesamt 2012).

More than thirty years after Mincer's contribution on the family, Galor and Weil (1996) created a model which was based on the idea that increasing capital per worker would imply a rise of the relative wage of female workers. This, in turn, would lead to a reduction in the size of the family which would imply that child-rearing activities and female labor supply would substitute each other (Galor 2005). Concerning the development of women's income as a percent of men's, similar to the participation rate of women in the labor market, women's relative income has risen relatively stably since the 1960s. Latest Figures show that the percentage of women's income by men's income now clearly exceeds 50 percent, whereas the same Figure amounted only to less than 40 percent in 1960 (BFSFJ 2005: 219).[5]

Althammer and Wenzler (1996) exhibited that the decision on the allocation of working time would take place within households and was dependent on the husband's wage. The total fertility rate in East Germany was the lowest in the world at 0.77. Eberhard Schaich (1998: 94-105) stressed that from 1991 to 1995 the rate remained constantly under 1. He offered several explanations for this, such as a pessimistic assessment of the future of young women because of the new political situation and many job losses during that period. In addition to new alternatives to the traditional family pattern, new job opportunities and consumption possibilities had emerged. After some time, an alignment to the demographic situation in West Germany began to occur.

Kleinhenz (2004) dealt with the consequences of the demographic change. He stressed the impact of the sudden drop in birth rates due to the birth control pill. Further explanations are associated with balancing the different demands between the workplace and family life since most women tend to have fewer children at a later age (Kohler et al. 2002). The increase in life expectancy and the technological change taking place is accompanied by higher wages. This, in turn, leads to more educational attainments across the population in order to acquire time-intensive human capital (Cervellati/Sunde 2007).

According to recent research in this area, the rational choice approach forms a conceptual framework which is likely to be consistent and gives an account of both the economic and fertility transition (Cervellati/Sunde 2007). It appears that from today's point of view, the basic changes in mortality and fertility are dependent on the reallocation of family resources (Schultz 2009). Furthermore, the latest research shows that even prior to the demographic transition, the Q-Q trade-off had existed (Becker et al. 2010). There has been an extensive empirical literature on both human capital and family economics in recent years in the area of population economics. The majority of that literature concludes that factors such as marriage, work, wages, and schooling as well as a high labor

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[5] Percentage of women's income by men's income. The income is cumulated on the basis of the average annual earning points and the average insurance years when retiring. From 1990 on it is weighted by the proportion of East (about 20 %) and West Germany (about 80 %).

force participation rate of women all affect fertility to a great extent (Browning et al. 2011).

7 Conclusions

To sum up, as Table 1 shows, right after the introduction of the *Journal* and within the very first 30 years of its existence, the *Journal* only rarely addressed issues regarding fertility. The reason might be that before the turn of the century, a relatively high fertility rate was observed and there was no need to put fertility on the agenda. Later, during 1893 – 1937, the situation changed. Most attention throughout the existence of the Journal has been paid to fertility between 1893 and 1937. This might be explained by the dramatic decline in fertility during that time. However, in the following years, from 1938 to 1967, the topic received very little interest from the *Journal*. An explanation could be on the one hand, that owing to the war the topic became less important and, on the other hand, Germany faced a post-war baby boom during the economic miracle which also might have resulted in less interest and thus publications in the area of fertility. Nevertheless, during 1968 and 2012 more attention has been paid to fertility in the *Journal*, which might refer to the relatively stable and low level of fertility since then.

Deliberations on population economics in Germany have lost nothing of their importance as a closer look at the trends and the number of works in the *Journal* regarding fertility confirms. As we have found, the three explanatory approaches (i.e. Malthus' early contributions, the rational choice theory and self-regulation) have all appeared in the *Journal* in some way over time. Whereas Malthusian concerns of food scarcity due to overpopulation were shared 1899 for the last time, treaties dealing with the explanatory approach of self-regulation appeared even in 1915 (Kollmann) and 1923 (Oldenberg). Nevertheless, the concept of self-regulation was not noticed in the *Journal* after 1923. As already explained, the German economist Brentano in 1909 was the first to point out the direct and negative correlation between welfare and matrimonial fertility. Thereby, he laid the groundwork for Becker (1960, 1981/1991) and Mincer (1963). Brentano (1909) suggested, in essence, that the decline in fertility was related to various activities from which the household could choose. By doing so, Brentano was a fore-runner of modern-day population economics.

Subsequently, the rational choice approach became the dominant stream to explain the course of fertility in the area of population economics. The approach which is based on the rational choice theory seems to provide a plausible answer to many questions raised in this article. It appears that the benefit of children was higher before the demographic transition. After the end of the transition process, the decline in the child mortality rate and the wide establishment of a social security system led to a diminishing benefit of children. At the same time, to ensure children the same standard of living, parents faced increasing costs of rearing children. However, since the 1970s the total fertility rate has remained relatively stable – but at a much lower level.

The displayed explanatory approaches have contributed to the development of theory in the area of population economics. The Q-Q trade-off seems to be an appropriate method of investigation. However, it remains a theory of limited scope. The authors neglected the influence of social groups on fertility. All in all, the determining factors concerning the development of fertility appear to be diverse. Some may be due to unique historical circumstances, such as the two World Wars, others depend on the changing socio-economic conditions and cultural factors. Therefore, the development seems to depend on various

issues such as economic changes, social circumstances, and a comprehensive process of modernization (Leibenstein 1974: 468-471). One question that remains unanswered is, as (Leibenstein 1974: 471) puts it: "A sensible theory must take into account competition between the budgetary demands for expenditures on children versus pressures for other expenditures as the social and economic circumstances change in the course of economic development. Where do these pressures for other expenditures come from?"

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Monetary Theory and Monetary Policy: Reflections on the Development over the last 150 Years

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Summary

In this paper, we provide some reflections on the development of monetary theory and monetary policy over the last 150 years. Rather than presenting an encompassing overview, which would be overambitious, we simply concentrate on a few selected aspects that we view as milestones in the development of this subject. We also try to illustrate some of the interactions with the political and financial system, academic discussion and the views and actions of central banks.

1   The early days

The birth of the "Journal of Economics and Statistics" in 1863 sets the start for our reflections on the development of monetary theory and monetary policy over the last 150 years. It is obvious that it would be overambitious to try to cover this period in an all-encompassing manner. Therefore we will concentrate on a number of aspects which we see as milestones in the development of this subject. In this context we will also refer to some articles published in the Journal which reflect these developments.

Like hardly any other field of economics the development of monetary theory and monetary policy in the course of time reflects the influence and interaction between the political and financial system, academic discussion, and the views and actions of central banks. In the words of Wicksell (1906: 3/4): "…the choice of a measure of value, of a monetary system, of currency and credit legislation – all are in the hands of society, and natural conditions (e.g. the scarcity or abundance of the metals employed in the currency, their chemical properties, etc.) are relatively unimportant. Here, then, the

rulers of society have an opportunity of showing their economic wisdom or folly. Monetary history reveals the fact that folly has frequently been paramount; for it describes many fateful mistakes."

At the time when the Journal was first published, the state of monetary theory in "Germany" was anything but well developed (Rieter 2002). To a large extent this was due to the fact that Germany as a state was created only later (in 1871) implying that a large number of currencies existed and that the financial system was very fragmented and hardly developed (Häuser 1998). This is a special case of a general observation: The development of monetary theory through the centuries is strongly related to the state of the financial and monetary system of the time (Born 1981). This is e.g. true for the "discovery" of the quantity theory of money at a time when large price increases were observed in the 16th century, and Bodin (1577) and others identified the increase in money resulting from the Spanish conquests in America and the following silver and gold imports in Europe as the cause for rising prices throughout Europe.

Later centuries saw a disastrous experience with paper money (John Law), the problem of convertibility triggered by wars, the choice of gold versus silver or of both (bimetallism), and the debate on what should be counted as money (see e.g. Rist 1938). These phenomena in real economies were reflected in theoretical discussions in the context of the Bullion Report and the currency-banking controversy. During that period the discussions in the German economic literature remained on the sidelines. However, this changed after the middle of the 19th century. Although his work is widely forgotten Carl Knies (1873, 1876, 1879) was an outstanding figure in his time and the thorough analysis of the functions of money remains exemplary (Häuser 1996).

The debate between supporters of the banking and currency theory had immediate practical consequences in the form of the organization of central banks. The foundation of the Reichsbank in 1876 reflects the dominance of the reception of the banking theory in Germany (Holtfrerich 1988): the circulation of money was seen as being dominated by developments in the real sector. Adolph Wagner, who had already triggered a discussion in Germany on the Banking Act of 1844, is the main representative for the dissemination of the banking theory (Wagner 1873).

Some articles in the early years of the Journal reflect the discussions in England, however, contributions on the situation in Germany dominated. Theoretical papers do not deserve further comment from today's perspective as theory remained without any significant impact on the evolution of monetary theory. The publication by Laspeyres (1871) on the proper calculation of price developments represents an early highlight in the field of measurement.

2   Wicksell and Hayek – a neglected dissent

Before continuing the line of connecting changes in the real world of money and finance with developments in theory we would like to highlight a dissent between two eminent researchers in this field. Knut Wicksell's "Geldzins und Güterpreise" (1898) is a milestone in monetary theory. As German was the publishing language of many Scandinavian economists at that time, it is not surprising that Wicksell expressed his ideas first in an article in the "Jahrbücher" (Wicksell 1897).

Wicksell's seminal contribution is based on his distinction between the natural and the nominal interest rate and the consequences for the development of prices once

the nominal interest rate differs from the natural rate. Hayek (1931) explicitly praises Wicksell for this innovative idea. However, he comes to the conclusion that with all merits of Wicksell's approach he makes a mistake by claiming that the coincidence in equilibrium of the natural and the nominal interest rate represents always a constellation which keeps also the price level constant (Hayek 1931: 22). The consequences of Hayek's correct critique are far reaching. If we define neutrality of money as a situation in which the interest rate is in equilibrium, a situation of a stable price level is not necessarily consistent with this condition (Hayek 1933).

For Hayek, not a constant price level, but the neutrality of money, i.e., the idea that money does not influence, that is to say distort relative prices, is the benchmark for the conduct of monetary policy. The implicit challenge is obvious: What are the consequences for the economy if monetary policy follows the goal of price level stability (or low and stable inflation)? Is the implicit "non-neutrality" relevant? Is "neutrality" a concept of any relevance for the conduct of monetary policy? Hayek's discussion of a constant money supply sounds even odder today than 80 years ago. What is the relevance of the "optimal money" developed by Friedman (1956)?

For his well known book Woodford (2003) not only uses deliberately the same title as Wicksell, but also takes the same position on this issue. Interestingly, Hayek and his critique are not even mentioned. As Woodford's approach had such a big influence on monetary theory and policy recently, it might be interesting to resume this debate.

3   From gold to paper

With respect to the origin of the "Jahrbücher", we have tried to give a very short summary of the state of monetary theory in Germany at that time. The journal also contains a number of reviews of important books. Although this overview is still very rudimentary, due to lack of time and space we will now concentrate on main developments. This selection reflects our priorities and is anything but encompassing.

The 19th century finally saw the triumph of the gold standard following the British example. Monetary policy was dominated by the principle of gold convertibility, i.e., it was constrained by the balance of payments[1] and monetary theory explained how gold movements influenced the quantity of money and thereby the price level in individual countries. In Germany this period was characterized by the coincidence of several fundamental factors, namely a new state (1871), a new currency (1873), and central bank (1875), as well as deep changes in the economy (Borchardt 1976).

The collapse of the gold standard in the context of World War I caused the deepest change of the monetary system in the history of mankind. Before, with a few exceptions money either consisted of physical entities of scarce goods or was "backed" by gold or silver.

In theory a debate had started on the "nature" of money and its functions (see e.g. Menger 1970). A special German contribution by Knapp (1905) defined money by its legal tender character (for a discussion see Ellis 1934 and Krohn 1986) – money was a "creation of the state", an idea which obviously was not helpful to explain the emergence of inflation and to develop a solution for ending the disaster.

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[1] Bloomfield (1959) argued that there was a habitude in managing the currency. For a critique, see Issing (1965) who argues that the principles of the gold standard dominated over "management". On the currency reforms after the founding of the Deutsche Reich and the "automaticity" of the gold standard see also Borchardt (1976).

Conceptually, paper money (to be correct: a paper standard), i. e., a currency with de facto zero production costs, "represents the logical culmination of the history of the development of money" (Helfferich 1923: 665). With the outbreak of the First World War in 1914, Germany was de facto under a paper standard and the government (Reichsregierung) had direct access to central bank credit. Unfortunately, the experience in Germany at that time revealed the rather dire side of paper money. After the lost war a return to the gold standard was not an option. To conduct monetary policy under these circumstances was obviously a tremendous challenge.

The interaction between the economic situation and the development of monetary theory became most intensive during the period of hyperinflation in Germany after the First World War ending in the collapse of the currency (Mark) in November 1923. Over this debate one should not overlook the fact that monetary theory before had made substantial progress. Already in the first edition of his most influential book von Mises (1912) had warned against any interference of the state into the value of money. Schumpeter (1917) starts from an "income approach to the value of money" (Rieter 1971) and then analyses the quantity theory of money in all its aspects, and finally comes to the conclusion that the general level of prices is determined by the quantity of money. One might think that this should have equipped the central bank with a solid theoretical fundament.[2] As will be shown below the opposite was true.

Inflation had started already during the war and finally accelerated to record levels in the years 1922/23.[3] The discussion on the explanation of inflation went along the lines of the old "Bullion versus Banking School" controversy (Holtfrerich 1988; Rieter 1971).

The Reichsbank supported the "balance-of-payments theory". As knowledge of this approach might have disappeared, Figure 1 shows its main elements (Eucken 1923).[4]

The initial cause for inflation is the deficit in the balance of payments, due to the reparation payments which via the transmission mechanism pictured in Figure 1 finally ends in inflation. As a consequence of this interpretation, the Reichsbank rejected any responsibility for inflation even when inflation reached unprecedented levels. President Havenstein defended the Reichsbank against its critics, e. g. in a meeting of the Zentral-ausschuss on 25 August 1923 arguing: "There is no doubt that by giving credit, a central bank increases the circulation of banknotes; however, insofar the central bank gives credit which is economically justified and necessary, as it serves production and turnover of goods, it does not create artificial purchasing power" (Protocol, p. 2; translation by Issing). At the same time the Reichsbank apologized for not being able to satisfy fully the demand for banknotes and justified the decision to keep the discount rate constant (since 1914) at 5 % until 28 July 1922.

A prominent opponent of this explanation of the causes of inflation by the Reichsbank and its monetary policy was Eucken. He rejected the balance of payments theory, and on the basis of his quantity theory approach saw the cause in the increase in the quantity of money triggered itself by the public deficit and the artificially low central bank interest

[2] An article by Bendixen (1919) published in this journal might be mentioned where the author is criticizing the concept of "metallism" as the fundament of money and develops arguments in favour of Knapp's theory.

[3] It is interesting to note that it were foreign authors like Bresciani-Turroni (1937) who published the first authoritative book on the German hyperinflation.

[4] The English version is taken from Holtfrerich (1986).

Passivity in the balance of payments
(primarily caused by the Peace Treaty)

↓

Outflow of paper money

↓

Rise on the price of foreign exchange

↓

Increasing commodity prices in Germany

Government budget deficit

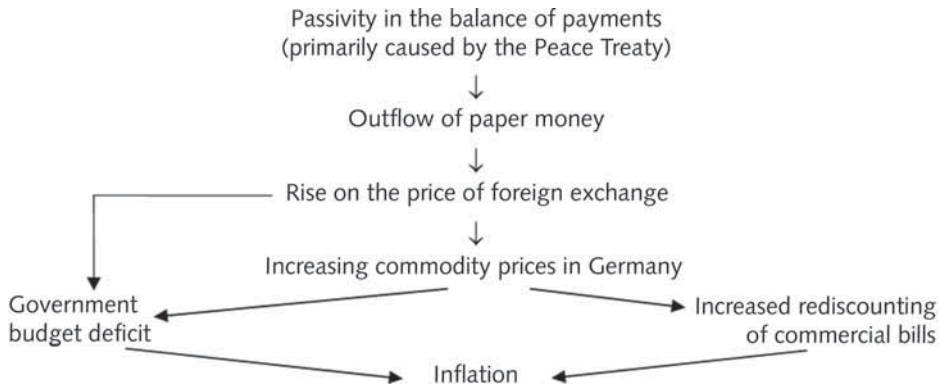Increased rediscounting of commercial bills

Inflation

Figure 1 Balance of payments theory

rate. Following his analysis, inflation could only be stopped by closing these sources with the consequence of restoring the needed scarcity of money.

For Eucken the interpretation of the causes of inflation by the Reichsbank was totally flawed, and for modern readers it looks just odd, and is of interest only because it inevitably led to hyperinflation. So it is no surprise that this theory has totally disappeared (however, not the notion of the endogeneity of money creation).

So, the Reichsbank has to take the full responsibility for the inflation because it was misguided by a wrong theory?[5] Borchardt (1972) has a rather sobering argument on this debate. In short, in his opinion the war with all its consequences, especially the fact that it was lost left hardly any option to contain inflation. Therefore, any theory of inflation not respecting the political circumstances cannot explain properly what happened in Germany in these years.[6]

Von Mises can be seen as the leading expert of monetary theory in this period. It would take much more space to do justice to all the aspects analysed in his impressive work "The Theory of Money and Credit" (1980), the English translation of the second edition (1924) of the book already mentioned above. He already develops the purchasing power theory. He strictly rejects Knapp's legal concept of money, and systematically applies marginal utility theory to explain the value of money. Whereas this approach, adopted by Wieser (1927), had no lasting impact on monetary theory, his analysis of the detrimental effect of the influence of the government on the value of money was validated since time and again. His conclusion is short and strict: "Sound money still means what it meant in the nineteenth century: the gold standard" (von Mises 1980: 480). In his pleading for currency competition Hayek (1990) refers repeatedly to the work of von Mises and his argument that it was not "capitalism" but government intervention which has

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[5] Initially, the Reichsbank saw its policy being supported by an international consensus of central bankers. However, this changed in the course of 1923 (James 1999).

[6] For a short survey of the political circumstances see e.g. Rieter (1971). Cagan (1956) in his seminal work shows that an extreme rise in prices depends almost entirely on changes in the quantity of money. However, a precise analysis of the determinants of money supply cannot be purely mechanistic, but would involve the motives of governments, "with whom the authority to open and close the spigot of the note issue ultimately lies".

been responsible for the recurrent crises of the past. But for Hayek, currency competition rather than the gold standard is the solution.

Overall, these and other publications not mentioned here indicate that German speaking economists had closed the gap relative to the international standard of monetary theory which had existed before. This is e.g. demonstrated by a secret conference in the middle of the crisis in September 1931 which brought together important political actors and leading academics which by itself is a remarkable and rare event. At this gathering the "crème de la crème" (Borchardt/Schötz 1991) discussed whether and how the Reichsbank could and should help to finance measures to create jobs. Although the discussion was focused on a plan to stimulate the economy via deficit spending by the "German Keynes", Wilhelm Lautenbach, important arguments were based on monetary theory. The quality of the exchange of views in these two days at the conference is also an indication of the loss in intellectual capacity thereafter due to the brain drain and the isolation during the Nazi regime.

4 Currency reform in Germany 1948

Only one generation and another lost war later, Germany was again confronted with the challenge of a currency ruined by inflation. This time the destruction of the value of money was not evident in the inflation rate as prices and wages were controlled (the so-called "stopped inflation"). As a consequence, a huge monetary overhang had to be dealt with. Numerous plans were developed how to solve the problem (Möller 1961). The currency reform of 1948 was encompassing as it addressed not only monetary and banking issues but also matters beyond money like distributional aspects (Lastenausgleich). On 20 June 1948 the new currency was introduced – an act which also implied monetary division between West Germany and the East. The impact of the introduction of the Deutsche Mark on the (West) German economy has to be seen in context with the measures to liberalize the economy for which Ludwig Erhard was responsible (Möller 1976; Buchheim 1999).

As it turned out with the new currency (West) Germans for the first time in two generations experienced a stable currency. Indeed, the Deutsche Mark became one of the most stable currencies in the world. Over its 50 years existence the average annual inflation rate was 2,6 %. What is of particular interest in this context is to what extent this was due to following the right monetary theory in the conduct of monetary policy. Two aspects are key:

The first is the institutional arrangement initially established by the allies and later included in the law on the Deutsche Bundesbank (1957) which gave the central bank independence and a mandate for maintaining price stability.[7] For the development of monetary theory and policy this is a remarkable fact as the independence of the central bank was at that time hardly an issue in the international discussion, and when it was raised there was not much sympathy for such a statute. It was only after the "great inflation" of the seventies when institutional aspects were intensively discussed and empirical studies revealed a strong correlation between central bank independence and inflation (Issing 1993).

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[7] Article 3 of the Bundesbank act defined the aim as "safeguarding the currency" which included both external and internal stability – a combination impossible to be realized in a world of inflationary developments. However, this legal goal was more and more interpreted as stability of domestic prices.

It is true that the success of the monetary policy of the Bank deutscher Länder and then the Deutsche Bundesbank did not only rely on its legal status but was also firmly based on the support by a population which had lost its wealth invested in financial assets twice in a generation. But there is no doubt that the example of the Bundesbank played also a role in the development of institutional aspects of monetary policy.

The second issue concerns the theoretical fundament of the German central bank's monetary policy (Neumann 1999). The early years were dominated by a pragmatic approach within the constraints of a fixed exchange rate (Emminger 1976; Schlesinger 1976). Monetary targeting was the new strategy announced in 1975 for the first time.

5   After World War II: Paper standard under fixed exchange rates

In contrast to the situation after World War I the idea of a return to the gold standard was totally discarded. Paper money standard remained the only option. As a consequence of the Bretton Woods Conference in 1944 and the following statute for the International Monetary Fund, the Western world entered a period of fixed exchange rates. Once foreign exchange controls were abolished the idea that under such a regime monetary policy could be directed towards domestic goals like price stability or full employment turned out to be an illusion. A fixed exchange rate, free capital flows and a sovereign monetary policy form an "impossible trinity" (Mundell 1973) which means that only two of the three goals are mutually consistent.

The collapse of the regime of fixed exchange rates in 1973 opened a new era for the conduct of monetary policy on the basis of a paper standard. Once again, a new period started in which the interaction between economic events, not least the "great inflation" of the seventies, and the development of monetary theory opened a new chapter.

This is also true for the "opposite direction" most notably to be observed in Europe where first a regional regime of fixed exchange rates (European Monetary System) was established before the ultimate solution of creating a single currency shared by initially 11 and later (2012) 17 countries was adopted.

6   Keynesianism versus monetarism and the impact on monetary policy

The development of monetary theory since the end of World War II is marked by a series of traditional topics as well as by new aspects. On the neutrality and value of money Patinkin (1965), for example, must be mentioned (also in the context of the real-balance-effect). For a while the controversy on inside-outside money triggered a lively debate (Gurley/Shaw 1976; Pesek/Saving 1969). There is a legion of publications. For an early survey see Johnson (1962); encompassing Friedman and Woodford (2011).

Although these theoretical developments and the accompanying empirical work on, e. g., demand and supply of money are also of relevance for monetary policy, we will concentrate here on the main controversy which had a direct impact. This controversy can be summarized under the headline of this paragraph: Keynesianism versus monetarism.

The 1950s and 60s were the time when Keynesianism dominated worldwide. Keynesianism here means the monetary theory originating in Keynes' "General Theory", developed further by Hicks, Modigliani, and many other proponents which Herbert Stein (1990) coined "simple-minded Keynesianism". The view that there was a permanent and stable

trade-off between inflation and unemployment was propagated by an influential study on the Phillips-Curve by Samuelson and Solow (1960). As a consequence society seemed to be able to choose according to the "menu". Fiscal policy was the powerful instrument to guarantee full employment. Monetary policy had no major role to play and should be coordinated with the government's policy. Tobin's (1965) contribution worked in the same direction. The view that "money" was of minor (if any) importance was a main element of the "liquidity theory" for which the Radcliffe Report (Committee 1959) can be seen as a representative survey.

As far as monetary policy was based on theory central banks world-wide followed these ideas. In the first place this is true for the Fed as it is analysed in detail in Allan Meltzer's authoritative history (2009). The philosophy of "money does not matter" is encapsulated in a remark by the former chairman William McChesney Martin, Jr. "They don't really know what the money supply is now, even today. They print some figures ... but a lot of it is just about superstition."[8]

The reception of Keynesianism in Germany after 1945 happened step by step reflecting a dispute between the older rather negative and the younger, supportive generation (Richter 1999a,b). A bundle of objectives was the orientation for the central bank's monetary policy. Bank liquidity was the main target of the Bundesbank's actions. Over time the concept of free liquid reserves was the guideline for the conduct of monetary policy.

However, under the regime of a fixed exchange rate, even during the years of foreign exchange controls, the conduct of monetary policy was confronted with the balance of payments restriction (Emminger 1976; Richter 1999b). Having been a strict supporter of a fixed exchange rate for the DM against the US dollar, after the introduction of convertibility the Bundesbank's policy was more and more marked by its fight against the impact of the consequences of surpluses in the balance of payments. To what extent external considerations dominated monetary policy decisions is, for example, demonstrated by the fact that in November 1960 the Bundesbank lowered the discount rate from 5 % to 4 %, in order to reduce the interest rate spread to foreign markets, notwithstanding the fact that the domestic situation would have required the opposite. Over the period from 1951-1973 the foreign component dominated the source of the money base (see e. g. Issing 1996). Under these circumstances the Bundesbank moved gradually in its position from supporting appreciations of the exchange rate to later favouring a regime of a flexible exchange rate. Eventually, price stability had turned into the single monetary policy objective.

While the Keynesian doctrine was still dominating, an intellectual challenge was emerging which was later called the monetarist counterrevolution. Milton Friedman was the key figure publishing a series of influential papers. His voluminous "A Monetary History of the United States" (1963) written with Anna Schwartz became sort of the benchmark of how empirical studies should be conducted. In his "A Program for Monetary Stability" (1960) he proposed a fundamental change of the financial system (100 % minimum reserves) and his famous k-percent rule, according to which money supply should increase steadily by 4 % year per year. This extreme approach was never considered as a practical advice for the conduct of monetary policy and later also rejected by Friedman himself.

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[8] Quoted in Meltzer (2009: 267).

However, the main message of monetarism (Friedman 1968; Brunner/Meltzer 1989) had a lasting influence on monetary theory and policy (Laidler 1981).
1. Money demand is a stable function of a few key variables.
2. Discretionary monetary policy – not least because of long and variable time lags – causes volatility in output and employment and has no permanent impact.
3. The Phillips trade-off cannot be exploited, unemployment is determined by the natural rate.

As a consequence monetary policy should follow strict rules for the control of money geared towards price stability. Tobin (1980) coined the term Monetarism Mark I in order to distinguish it from Mark II, which included Robert Lucas's (1972) contribution that markets forming rational expectations make any attempt of a discretionary systematic monetary policy ineffective. The so-called Lucas critique (1976) explained why the structural parameters of existing models change under the influence of policies and could therefore not be used for the simulation of outcomes.

The emergence of monetarism triggered a debate which can be seen as one of the most productive developments not only in monetary theory but for macroeconomics as a whole. Two new journals were founded which soon became a platform for a worldwide discussion (Journal of Money, Credit and Banking; Journal of Monetary Economics). In Germany Manfred Neumann (1971) became the leading German monetarist (for his assessment of the Bundesbank's policy, for example, see Neumann 1999).

These developments in monetary theory were a challenge for central banks. The Deutsche Bundesbank can be seen as an outstanding example of a timely, but reflected reaction to new research. The move from a fixed exchange rate to floating on March 19, 1973 created the fundament for the choice of a monetary policy strategy geared to a domestic goal which was price stability. As the first central bank in the world the Bundesbank in December 1974 announced a growth target for the money stock in 1975. The choice of a monetary target signalled a fundamental regime shift. This decision was based on two arguments. First, and foremost, was the adoption of an intermediate target, i.e., the intention of controlling inflation through the control of monetary expansion. Second, the Bundesbank tried to provide a guidance for agents', especially wage bargainers' expectations through the announcement of a quantified objective for monetary growth (Schlesinger 1983).

The Bundesbank was convinced that, while monetary policy maintaining price stability in the longer run would exert a positive impact on economic growth, fostering potential growth in the economy should be considered a task of fiscal structural policies, while employment was a responsibility of the social partners conducting wage negotiations.

The new strategy was seen as an experiment and the first experiences with monetary targeting were not particularly encouraging. However, the Bundesbank had made it clear from the beginning that it could not and would not promise to reach the monetary target with any degree of precision.

After the first years of experience the Bundesbank enhanced the monetary target concept from its experimental stage into a fully fledged strategy (Issing 1992, 1997; Neumann 1999). While details of the concept were adapted from time to time, monetary targeting remained the strategy until the end of the DM in 1998. The Bundesbank on the one hand based its strategy and the consequent monetary policy to a large part on the monetarist theory, the flexibility which it demonstrated in the implementation, on the other hand however, raised critique by the monetarists right from the beginning.

"Pragmatic monetarism" as this policy has been called – which was in line with the central bank's own interpretation – met its first hard test in the seventies, and successfully stood the test. Germany avoided the "great inflation" which hit other countries (Issing 2005; Beyer et. al. 2008). Confidence in the DM as a stable currency was maintained also throughout the nineties during the turbulences of unification.

7 The "great inflation" and rational expectations theory

This is not the occasion for a comparative study. However, it is interesting to briefly contrast monetary policy and its results in Germany relative to other countries during the seventies. Figure 2 shows inflation in the G7 economies from 1960 to 1995 measured by the rate of change of the Consumer Price Index. It is no surprise that commentators have dubbed the seventies the period of the "Great Inflation". Inflation reached double digits in 1974/75 in all of them but Germany – and a second time around in 1980/81 except for Germany and Japan. Initial price rises emanated from oil prices, but central banks were responsible for the lasting impact.

The most important reasons for the U.S. Federal Open Market Committee's disappointing performance during this period can be seen in the continuation of a discretionary monetary policy that was focussed on two targets – employment and inflation – and was misguided due to unreliable indicators like the output gap (Orphanides 2002), reliance on the Phillips curve trade-off and neglect of money (Meltzer 2009). When this policy ended in stagflation, the FOMC under Chairman Volcker reoriented its policy in the direction of pragmatic monetarism (Meltzer 2009). While the Bundesbank was confronted with similarly biased output gap estimates (Beck/Wieland 2008), its commitment to the primacy of the price stability objective and the monetary strategy helped it avoid the inflation excesses experienced in the United States and elsewhere.
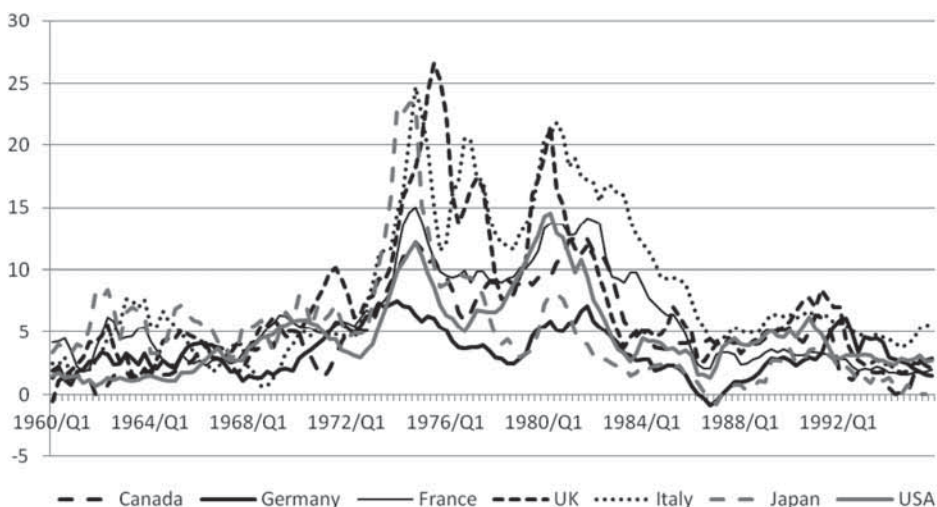
Notes: 4-quater average rates of change of the Consumer Price Index (CPI) in percentage points. *Source:* OECD.

Figure 2 Inflation in the G 7 Economies – 1960 to 1995

The "great inflation" had a huge impact on monetary theory. Against this background, rational expectations theory quickly came to dominate macroeconomic research. The expectations-augmented Phillips curve (Phelps 1967) implied that only inflation surprises would have an impact on real GDP and employment. Thus, anticipated changes in monetary policy would not affect the real economy (Sargent and Wallace 1975, Taylor 1975). Kydland and Prescott (1977) showed that a central bank attempting to exploit the inflation-unemployment tradeoff would only induce greater inflation without raising employment – the so-called time inconsistency problem. Since this outcome may be cast as a Nash equilibrium in a dynamic game between the central bank and private sector price setters, a substantial literature ensued that applied game theory to monetary policy analysis. It emphasized the importance of reputation, credibility and transparency in policy making (cf. Barro/Gordon 1983, Cukierman/Meltzer 1986) and provided theoretical foundations for the institutional independence of central banks (Cukierman 1992). Research in this vein also indicated that the time inconsistency problem can be alleviated and inflation reduced, if central banks are assigned the pursuit of price stability as their primary objective and use explicit monetary targets (Rogoff 1985; Garfinkel/Oh 1993), as in the case of the Bundesbank.

8 From the Lucas critique to the Taylor rule

While monetary policy modeling based on the natural rate hypothesis and rational expectations helped clarify how better institutional design can improve inflation performance, its implication that anticipated policy decisions had absolutely no effect on the real economy did not agree with practitioners perceptions and empirical readings. New Keynesian contributions such as Fischer (1977), Phelps and Taylor (1977), Taylor (1979a) and Calvo (1983) used long-term nominal contracts, for example staggered wage contracts, to explain how monetary shifts could cause real fluctuations even if expectations are rational and the shifts are anticipated. Models with such contracts were estimated empirically and found to fit the persistent fluctuations in output and inflation.

As a consequence of the nominal rigidities, monetary policy is faced with a trade-off between inflation and output volatility. This trade-off or Taylor curve is stable in the sense that it is possible for the central bank to pick a particular combination of output and inflation volatilities depending on its preferences. However, this finding did not provide a new argument for discretionary policy. Rather, it strengthened the case for choosing a policy rule that would serve to stabilize macroeconomic outcomes, including private sector expectations. Using an estimated model of the U.S. economy Taylor (1979b) showed that Friedman's constant money growth rule would have achieved a lower degree of price level and output variability than actual U.S. policy. Furthermore, he derived optimal feedback rules for real money balances. The purpose of such analyses was to present new econometric methods for selecting macroeconomic policy when expectations are formed rationally, thus taking into account the famous Lucas critique.

The new methods caught on and induced a wave of New Keynesian modeling. Models with nominal rigidities and rational expectations were extended and enlarged and eventually applied rather intensively in practical monetary policy analysis at central banks and institutions such as the International Monetary Fund. Models of this type that featured in U.S. policy discussions in the early 1990s include Taylor's (1993a)

multi-country model, Fuhrer and Moore's (1995) model with staggered real wage contracts and the Federal Reserve's FRB-US model (see Reifschneider et al. 1999 for a description). A version of the latter is still used at the Fed today.

New Keynesian modeling made more direct contact with the practical conduct of monetary policy, by specifying rules for the central bank's main policy instrument – the interest rate on central bank money such as the federal funds rate in the United States. For example, a large-scale international model comparison exercise conducted at the Brookings Institution (Bryant et al. 1993) evaluated the performance of such interest rate rules across a range of models. Interestingly, Taylor (1993a) credits this comparison project as the crucial testing ground for what later became known as the Taylor rule. Thus, he saw the rule as a useful normative guideline. It implied a quantitative prescription for increasing (lowering) the policy rate in response to higher (lower) inflation and deviations of GDP above (below) trend. Such systematic policy could be anticipated by market participants and help induce stabilizing expectations.

Interest in this rule quickly reached far beyond academic and central banking circles, because it matched the Fed's interest rate decisions between 1987 and 1993 surprisingly well, as Taylor had shown. Indeed, after the unavoidable, but costly disinflation policy administered under Chairman Paul Volcker, the Greenspan Fed succeeded in maintaining low inflation without much output volatility during this period. Later on, the period from the mid-1980s to the early 2000s became known as the "Great Moderation" because of the sustained reduction in business cycle fluctuations in output and employment along with low and stable inflation relative to the preceding post-war period. A number of studies such as Giannone et al. (2008) have rejected a "good luck" explanation and scholar such as Taylor (2011) attribute it to a switch from discretionary to rule-based policy making. While no central bank has formally adopted Taylor's rule as its policy strategy, nowadays Taylor-style rules are standard fare in the briefing materials of policy makers and the analysis of central bank watchers.

Before we pick up this thread again, we take a look at developments in monetary policy across the Atlantic and related issues in monetary theory. Following the breakup of the Bretton-Woods system, European governments were heading in a different direction than the United States and started to explore new monetary arrangements hoping to limit exchange rate volatility.

9   Europe and the Bundesbank: Via the EMS crisis to European monetary union

A concrete first step had already been taken at the European Economic Community summit in The Hague on 1 and 2 December 1969. Heads of state or government had agreed that a plan should be drawn up with a view to the creation of an economic and monetary union. Even so, the 1970 plan presented by the "Werner Group" – named after the then Prime Minister of Luxembourg – was not followed by further steps, because of disagreement over appropriate exchange rate policies. A Franco-German initiative eventually helped break the deadlock and the European Monetary System (EMS) came into existence in March 1979 (see Issing 2008).

In the EMS, exchange rates were set between the member currencies and interventions were compulsory if the parities threatened to breach certain bands. Here, we cannot do justice to the substantial literature on the economics of exchange rate target zones that flourished during this period (cf. Krugman/Miller 1992). However, it is important to

note that the European Currency Unit (ECU), though formally at the system's core, only played a limited role as unit of account. Instead, the EMS soon functioned as a Deutsche Mark area, centered on the strongest currency in the system (McKinnon 1993). Under this arrangement and with free capital flows, member countries could either align monetary policy with the Bundesbank, or re-align the parity. Typically this meant devaluing their currencies relative to the Deutsche Mark.

Tensions in the EMS escalated into full-out crisis in 1992/93. As a consequence of re-unification the German economy experienced a boom and rising inflation. The German boom implied a large, asymmetric shock to the system (see Wieland 1996). True to its mandate, the Bundesbank tightened policy and brought inflation back under control. Faced with the choice to raise the interest rate and accept its negative impact on domestic economic activity or to depreciate the currency, the United Kingdom dropped out of the system in 1992 and Italy stopped interventions. The permissible bands between the currencies remaining in the system were substantially widened in 1993. Notwithstanding substantial macroeconomic tensions in the context of re-unification the Bundesbank continued its strategy of monetary targeting. To signal its determination to keep inflation under control it derived the target on the basis of an unchanged number of two per cent for the price norm, but accepted the following overshooting (Issing 1992).[9] It succeeded finally in bringing down inflation.

The woes of the EMS did not distract but rather hasten the political process towards European monetary union (EMU).[10] The Maastricht treaty of December 1991 set out criteria for economic convergence and fixed the latest starting date for EMU at January 1, 1999. And indeed, by that date a new currency and a new central bank had been created. Eleven sovereign countries adopted the Euro and delegated monetary policy to the European Central Bank. Principles of monetary theory, such as central bank independence, primacy of the goal of price stability, and the prohibition of monetary financing where enshrined in treaties and European law. Fiscal authorities' tendencies towards excessive deficits and debt were meant to remain constrained even after convergence by explicit limits to be enforced by a stability and growth pact.

The young central bank aimed to gain credibility by announcing a numerical objective – HICP inflation below two percent over the medium term – as well as a policy strategy. The ECB's strategy became known as the two-pillar strategy, resting on an economic analysis of short- to medium-run inflation pressures, and a separate monitoring of longer-run inflation risks emanating from monetary trends (see Issing et al. 2001; Binder/ Wieland 2006). Thus, the ECB neither stuck to Bundesbank-style monetary targeting, nor did it adopt a Taylor rule or direct inflation targeting, but instead created a new policy framework. Its main competitor – inflation targeting – had become rather popular initially among newly-independent central banks in several small open economies since the 1990s. Theoretical foundations for this strategy will become clearer in the course of the next sections.

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[9] For a discussion of target misses as the central bank learned about the possibility of shifts in money demand see Wieland (2000). The price norm was the Bundesbank's version of a numerical price stability objective.

[10] For a thorough review see Issing (2008).

10 Real business cycle theory versus the New Keynesians

Lucas (1976) had asked for taking full account of the forward-looking and optimizing reactions of businesses and households in the formulation of macroeconomic policies. Ultimately, this approach required building macro models bottom up from the micro-economic utility- and profit-maximizing decisions of households and firms. Following this prescription, Kydland and Prescott (1982) proposed a new theory of macroeconomic fluctuations that became known as the real business cycle (RBC) approach. Their extension of the neoclassical growth model to study the real (rather than monetary) sources of business cycles delivered a modeling approach that stringently enforced all the restrictions following from the utility maximization of representative households and the profit maximization of representative firms on the dynamics of macroeconomic variables. At the same time they put forth technological innovations as the main drivers of business cycles. As to the monetary side, they returned to the policy ineffectiveness proposition of early natural rate theories. In perfect markets, stabilization policy was of no concern.

In the ensuing academic debate with RBC researchers, New Keynesians emphasized the need for including nominal rigidities as well as real market imperfections such as imperfect competition or imperfect information (cf. Mankiw/Romer 1991). Goodfriend and King (1997) and Rotemberg and Woodford (1997) presented a first monetary business cycle model using the approach to microeconomic foundation practiced in RBC research but also including imperfect competition and overlapping nominal contracts. They incorporated key features of earlier New Keynesian research in the dynamic general equilibrium framework used in the RBC literature. Thus, Goodfriend and King named it the New Neoclassical Synthesis model. In recent years it has been commonly referred to as the benchmark simple New Keynesian model.

A linearized version of this model consists of three simple equations, a forward-looking Phillips curve, a forward looking IS curve and a Taylor-style interest rate rule. The New Keynesian Phillips curve relates current inflation to expected future inflation and the deviation of output from a new measure of potential, the level of output that would occur under flexible prices. The IS curve or aggregate demand equation is derived from the consumer Euler equation. Thus, current output depends on expected future output and the expected short-term real interest rate.

The small-scale New Keynesian or New Neoclassical Synthesis model was quickly extended with additional decision aspects and constraints following the contribution of Christiano et al. (2005). Their model was estimated with euro area data by Smets and Wouters (2003). These models are typically referred to as New Keynesian dynamic stochastic general equilibrium (DSGE) models.[11] Nowadays, medium- to large-scale DSGE models are routinely used by economists at central banks and international institutions to evaluate monetary and fiscal stabilization policies. In contrast to the wide array of statistical nowcasting and forecasting models also employed at these institutions, DSGE models can be used for counterfactual policy simulations that respect the Lucas critique.

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[11] See Taylor and Wieland (2012) for a comparison of earlier New Keynesian models with state-of-the-art DSGE models using a new monetary model database that provides interested researchers with easy access to such models.

11 Inflation targeting and the role of money in monetary policy

In the early 1990s more and more countries took seriously the lessons of the "great inflation" and made it possible for their central banks to pursue price stability. To this end, they had to grant central banks a certain degree of operational independence and achieve control of public finances without taking recourse to seigniorage. The rational expectations literature as well as empirical experience in some countries served to highlight the potential for reducing the costs of disinflation by credibly signaling policy objectives to wage and price setters. In 1990, New Zealand and Chile tasked their central banks with a primary responsibility for price stability, and the central banks published official numerical targets for the rate of inflation. According to Bernanke et al. (1999) the responsibility for price stability and the numerical target are the two key elements that characterize the framework for monetary policy termed "inflation targeting". Soon, other countries followed including Canada, the United Kingdom, Sweden, Norway and Australia.

Inflation forecasts play a central role at inflation-targeting central banks in terms of signaling how they plan to achieve their target in the future, or on average. Some inflation targeting central banks have used Taylor-style rules with forecasts to characterize their strategy in model evaluations (cf. Batini/Haldane 1999). Alternatively, inflation targeting has been described as an optimal control problem with the inflation forecast as intermediate target (Svensson 1997). In this regard, Clarida et al. (1999) proved influential by deriving the implications of the simple benchmark New Keynesian model of the preceding section for the theory of monetary policy. Subsequent New Keynesian contributions have tended to consider inflation targeting an optimal approach to monetary policy (see, for example, Woodford 2007 and Wieland 2009).

The literature on inflation targeting is vast and many aspects of practical policy making have been integrated in its formal optimal control representation. For a recent exposition the reader is referred to Svensson (2010). In the remainder, we only put the spotlight on one aspect, namely the role envisioned for monetary aggregates, which was debated rather vigorously and involved somewhat extreme positions. Woodford (2008), for example, saw no reason to continue assigning a prominent role to monetary aggregates in policy deliberations. In his judgment, research on more refined models of money supply and money demand would not help understanding the kinds of uncertainty about the effects of monetary policy that are the actual obstacles to the development of more effective policy. These conclusions were consistent with the implications of the benchmark New Keynesian model for the relevant transmission channels of monetary policy.

Not surprisingly, the European Central Bank's continued adherence to a strategy with a prominent role for monetary aggregates triggered much criticism. This debate had important implications for practical policy at the time, because of its relevance to the question whether or not the sustained increase in money and credit growth from 2003 onwards should be a cause for concern.

Other central banks had largely de-emphasized money in the context of their strategies. Few studies argued in support of the ECB's position. Lucas (2007) expressed skepticism regarding the New-Keynesian model's ability to explain monetary trends, and proposed that central banks should continue to use monetary information as a kind of add-on or cross-check. Along these lines, Beck and Wieland (2008) suggested that cross-checking with monetary trends would help reduce the negative impact of output gap mispercep-

tions. Others focused on the use of money as a commitment device (Beyer et al. 2008; Christiano et al. 2008). A fundamental critique of inflation targeting was presented by Issing (2011). However, the global financial crisis that broke out shortly thereafter provided ample reason for re-considering the role of money and credit growth in monetary policy.

12 In lieu of a conclusion: Some thoughts on monetary policy and the global financial crisis

Having reflected on almost 150 years of the history of monetary theory and policy, we have returned to the present. The global financial crisis has been going on for almost five years. While it is too soon to summarize its impact on monetary thought and policy in a definitive manner, it is useful to highlight some developments and their likely impact. In doing so, we restrict attention to issues concerning monetary policy. While the financial crisis offers important lessons for financial regulation and supervision, including the responsibilities of central banks in these fields, these policy areas are beyond the topic of our review. Similarly, we refrain from discussing lessons for central banks' role of lender of last resort to financial intermediaries.

Monetary policy is always conducted in an environment with many sources of uncertainty. Unforeseen macroeconomic shocks, imperfectly understood and imprecisely estimated channels of policy transmission and macroeconomic propagation, and noisy empirical measurement render monetary policy design and implementation a challenging task. They were all part of the cast of the financial crisis. The collapse of housing prices and financing in the United States caused substantial and (at least partly) unexpected macroeconomic disruptions. The extent of financial risk, the fragility of financial intermediaries and the interdependence of the exposures of these institutions around the world were not well understood by decision makers in markets and policy institutions. To a significant extent, these sources of risk and disruption arose as unintended negative consequences of regulatory, supervisory, fiscal and monetary policies practiced prior to the crisis. The magnitude of the impact of financial disturbances on the other sectors of the economy was greatly underestimated. To give an example, while the Federal Reserve worried about a potential housing crash, its empirical models derived from historical data underestimated the impact of such a crash on the real economy. Finally, the course of events required policy makers to take recourse to unusual policy measures whose impact was subject to considerable uncertainty.

Certainly, all central banks have to reconsider the policy strategies they pursued prior to the crisis and assess whether these strategies are still appropriate for the future. As to the Federal Reserve's policy prior to the crisis, Taylor (2007) has pointed out that the federal funds rate remained too low for too long relative to the prescriptions of the Taylor rule. He provides empirical evidence that the deviation in interest rates was sufficient to account for at least part of the housing boom. From the Federal Reserve's perspective, the low interest rate policy prior to the crisis was justified by the outlook on inflation and economic activity (Bernanke 2010). Indeed, a Taylor-style interest rate rule, which includes FOMC forecasts of inflation and unemployment rather than recent outcomes, matches Fed policy very well (see Orphanides/Wieland 2008). The same rule, however, would have implied higher interest rates with Blue Chip CPI forecasts instead of the FOMC's prediction regarding inflation in the personal consumption expenditures

(PCE) deflator. Ex-post data revisions indicate that the FOMC under-predicted PCE inflation at the time.

As a consequence of its strategy and in contrast to other central banks, the ECB had to worry about the sustained increase in trend money growth prior to the crisis. At least ex-post, it is understood as a signal of the credit boom that led to inflated asset prices and financial risks around the world. Furthermore, it did have an influence on ECB decision making. Trichet (2008), for example, emphasized that the ECB decided to increase the policy rate in December 2005 against the advice of the IMF and OECD because the ECB's monetary analysis particularly strongly suggested that they should. Despite the policy tightening, money growth stayed high. Thus, it is a fair question whether the ECB should not have given more weight to its monetary pillar in setting policy rates prior to the crisis.

The role of asset prices in monetary policy has also been the subject of much research over the years, specifically whether monetary policy should involve a sort of "leaning against the wind" with regard to the development of asset prices. One view is to abstain from any reaction during the built-up of an asset boom, because of the difficulty involved in defining what is a bubble and what not, but to essentially pre-announce a rescue with ample liquidity provision once the bubble bursts. This view has been dominating for some time, particularly in the United States, given the seeming success of the Greenspan Fed in handling the 1986 stock market crash and other such events later on. This view also explains the reluctance of the Greenspan Fed to tighten policy more quickly during the period of the so-called "dot-com bubble" of the late 1990s and its aggressive easing following the correction in 2001. However, Issing (2009), who refers to this approach as the "Jackson Hole Consensus", points out that such an asymmetric approach may create moral hazard and encourage behavior that induces ever greater asset price bubbles. Instead, a strategy that includes cross-checks against monetary trends would implicitly lean against asset booms. As long as money and credit remain broadly controlled, the scope for financing unsustainable runs in asset prices should be limited. Similarly, Taylor (2007) implies that if the Fed would not have deviated from his rule, housing price increases would have been much more limited (see also Jarocinski/Smets 2008). While these arguments support the conclusion that monetary policy can act to stabilize financial markets, be it with communication or even moderate interest rate adjustments, monetary policy should not be left alone in this task. There are a number of tools, also of a regulatory nature, that can be deployed to ensure financial stability.

Having started this section on the financial crisis by acknowledging several failures and omissions of monetary policy, it is only fair to continue with highlighting some successes. In August 2007, when banks turned reluctant to lend funds to fellow banks and a 60 basis points premium emerged in the inter-bank money market, central banks stepped in and immediately increased liquidity provision. This response is essentially automatic in the standard policy framework that uses the price of central bank funds rather than its quantity as an operating target.

In the fall of 2008, when the ongoing recession became apparent and inflation rates dropped, that is after the Lehman collapse, central banks in leading industrial economies responded by aggressively lowering interest rates. As short-term money market rates started to approach the zero lower bound, central banks resorted to additional measures. Generally, these measures focused on reducing premia associated with longer-term interest rates and riskier assets and the quantitative expansion of base money. While the U.S. Fed focused more on direct asset purchases, the ECB relied to a greater extend

on longer-term repo operations with the banks. Thus, monetary policy helped averting a longer drawn-out recession and avoided any significant deflation. In the euro area, monthly HICP inflation rates dipped only shortly into negative territory, reaching a trough of -0.6 percent (annual percentage change) in July 2009, and quickly returned close to 2 percent by summer 2010. In the United States, monthly CPI inflation rates hovered near zero in the first few months of 2009, dropped to a trough of -2.0 percent in July but then quickly rose above 2 percent by December.

Of course, one may question whether the measures taken were excessive and less would have been sufficient. Also, the proper balancing of deflation scenarios with medium-term inflation risks is rightly debated. For the purposes of this paper, however, we want to emphasize that central banks were not surprised by the need for additional instruments with near-zero nominal interest rates. Ever since the late 1990s, when Japan started to experience near zero interest rates, low growth and slow deflation, monetary economists and central bank researchers have worried about how to conducted monetary policy with near-zero policy rates.

The zero-nominal interest rate floor arises because of the availability of cash as an asset that pays a zero nominal interest rate. Thus, savers need not accept less. In 1998/99 Federal Reserve economists investigated the role of a credible objective with a low but positive target rate for inflation in minimizing the risk of reaching the zero-interest-rate floor (see Orphanides/Wieland 1998) and exposited a wide range of policy tools that remain available once this constraint becomes binding (cf. Clouse et al. 2000 and Orphanides/Wieland 2000), including measures to influence longer-term premia and outright asset purchases with the aim of quantitative easing. The ensuing literature remained a niche for monetary policy experts for many years but yielded very useful insights for policy makers in 2008/2009.

When the European Central Bank conducted a mid-term review of its policy strategy in 2003, it concluded that "There are a number of well-grounded arguments for tolerating a low rate of inflation, and not aiming at zero inflation. The major concern is the need for a safety margin against potential risks of deflation. In a context of strong deflationary pressures, monetary policy may become less effective if central bank interest rate management is constrained by a liquidity trap, or a zero bound problem" (ECB 2003). Consequently, it affirmed that a quantitative definition of its price stability objective was a successful contribution to anchoring medium and longer-term inflation expectations and clarified that it meant to keep the rate of increase of the HICP below but close to two percent. The "close to" helped create a safety margin against potential risk of deflation, while the public commitment ensured that long-term inflation expectations remained positive and near two percent throughout the global financial crisis. Against this background, recent calls for giving up on past commitments to low and stable inflation in order to gain a much greater safety margin against deflation would appear to be misguided and possibly de-stabilizing (see Blanchard et al. 2010 for such a proposal and Issing 2011 for a rebuttal).

At the time of writing of this paper, the euro area remains mired in its own sovereign debt crisis. While euro area sovereigns' finances have certainly been impacted by the banking rescues triggered by the global financial crisis, the seeds of the euro debt crisis also lie in the failure to enforce the fiscal rules that were meant to secure a stable monetary union. A thorough discussion of the appropriate policy responses is best reserved for a separate article. Suffice it to say that the concerns of the founders of European Monetary Union regarding the independence of the central bank and the need for a

sustainable fiscal policy have been thoroughly validated. In this context, the violation or revision of the Maastricht fiscal criteria on Franco-German initiative a few years prior to the start of the financial crisis proved disastrous.

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