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The Impact of Globalization and Digitalization on the Phillips Curve

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Abstract

In this paper, we examine the impact of globalization and digitalization on the Phillips curve in a sample of 18 advanced economies over two decades. Using industry-level data from the World and EU KLEMS databases, we first estimate country-industry-specific Phillips curves for each decade by relating the growth rate of output prices to lagged inflation and an employment gap. We then assess the relative impact of globalization and digitalization on the slope coefficients of these Phillips curves, which represent the sensitivity of inflation to economic slack. We measure globalization by increases in trade and financial integration and digitalization by the use of industrial robots as a share of a country's population. We find that globalization significantly reduces the slope of the Phillips curve, while digitalization has the opposite effect. We also find some evidence that globalization decreases the intercept of the Phillips curve and that digitalization increases it. Evidence for the impact of both trends on employment is less conclusive. When investigating the associated transmission channels for both trends in the context of our slope analysis, we find that the negative impact of globalization on the slope coefficient of the Phillips curve is muted in industries that experience a high growth rate of total factor productivity and that the positive impact of digitalization is muted in industries that have seen high investments in IT capital in the past.

Topics: Business fluctuations and cycles, Inflation and prices, Labor markets, Trade integration, International topics, Recent economic and financial developments

JEL codes: E31, E32, F6, 03

1 Introduction

COVID-19 has impacted globalization and digitalization in opposing ways. On the one hand, globalization has fallen. Globalization characterizes the development of an increasingly stronger integration with the world economy where firms can easily access foreign capital and sell a considerable share of their production abroad. The global response to the pandemic and the associated collapse in demand have led to a significant drop in trade and financial linkages between countries, and thus, globalization has decreased significantly. Digitalization, on the other hand, has increased. Digitalization describes the change of firms' business models through the increasing use of digital technologies, such as the digitization of information and the automation of manual tasks. In particular, the physical distancing requirements related to COVID-19 have contributed to more online shopping, remote work, and use of industrial robots.[1]

While COVID-19 accelerated the opposing trajectories of globalization and digitalization, both trends had started to diverge before the pandemic. As Figure 1 shows,[2] both trends increased in lockstep between the 1970s and the beginning of the 2007-09 global financial crisis.[3] At the onset of the global financial crisis, globalization underwent a partial reversal, which was exacerbated by the 2018-19 trade tensions. Digitalization, however, has steadily increased since the mid-1990s and even accelerated more recently. Therefore, at this time, there is a particular interest in disentangling the effects of both trends on macroeconomic outcomes.

The importance of the relationship between globalization and, more generally, innovation, with inflation and economic slack was highlighted by Greenspan (2005) more than a decade ago: *"Over the past two decades, inflation has fallen notably, virtually worldwide, as has economic volatility. Although a complete understanding of the reasons remains elusive, globalization and innovation would appear to be essential elements of any paradigm capable of explaining the events of the past ten years."* More recent discussions on this topic show that objectives to obtain a better understanding of the effects of globalization and digitalization on the economy, and especially on inflation, are central to central banks' research agendas. In light of the existing policy challenges at the global level, the need to specifically understand the individual and joint contributions of globalization

[1] In this paper, we proxy digitalization by the use of industrial robots.

[2] Figure 1 uses the index for Overall Economic Globalisation from the KOF Swiss Economic Institute to measure globalization and the operational stock of industrial robots from the International Federation of Robotics (IFR) as a share of the total population of a country to measure digitalization. For more details on the data, see Section 4.1.2.

[3] It is also likely that both trends have been reinforcing each other over time. For example, the digitalization of information might have greatly helped economic globalization to take off in previous decades. At the same time, the presence of economic integration has increased the worldwide exchange of information and thus facilitated the propagation of digital technologies across the world.

and digitalization to the economy has become more important than ever. For example, recent pre-pandemic commentaries from policy-makers on this topic include, Carney (2017), who cautions of a potential increase in inflation due to an era of de-globalization, and Wilkins (2019), who highlights the challenges faced by central bankers in adapting monetary policy to advances in digitalization, and the potential for digitalization to disrupt industries and change the nature of work.

We contribute to this debate by providing preliminary evidence on the relative impact of globalization and digitalization on inflation and, in particular, on the slope of the Phillips curve, which represents the sensitivity of inflation to economic slack. While both trends diverge globally, their individual dynamics are heterogeneous across countries and thus highlight the benefits of approaching this question from a cross-country perspective. We proceed as follows. We first estimate industry-level Phillips curves for a sample of 18 advanced economies over two decades.[4] We then assess the impact of globalization and digitalization on the sensitivity of inflation to economic slack, represented by the slope coefficients of these Phillips curves. More specifically, we analyze the aggregate effects of both globalization and digitalization on the slope of the Phillips curve and also take a first look at their potential channels by interacting our country-level measures of globalization and digitalization with potential transmission channels at the industry level.

We find that globalization appears to reduce the slope of the Phillips curve on aggregate, while digitalization seems to have the opposite effect. These results are robust to a range of fixed effects specifications that absorb potentially confounding influences along the country, the industry, and the time dimension. We also find some evidence that globalization decreases the intercept of the Phillips curve and that digitalization increases it. Evidence for the impact of both trends on the natural logarithm of employment is less conclusive. When investigating the associated transmission channels for both trends in the context of our slope analysis, we find that the negative impact of globalization on the slope coefficient of the Phillips curve is muted in industries that experience a high growth rate of total factor productivity (TFP) and that the positive impact of digitalization is muted in industries that have seen high investments in information technology (IT) capital in the past.

Our paper is organized into five sections and proceeds as follows. Section 2 reviews the literature on globalization and digitalization with a focus on their effects on inflation and the Phillips curve. Section 3 presents estimates of industry-level Phillips curves for our sample of 18 advanced

[4] Our sample ends in 2015, and thus we are unable to cover more recent developments, such as COVID-19.

economies, which serve as the basis for our main empirical analysis in the next section. Section 4 assesses the impact of globalization and digitalization on the slope coefficients of these Phillips curves. In particular, it examines the impact of different transmission channels at the industry level. Finally, Section 5 concludes.

2 A Review of the Literature and Potential Transmission Channels

This section discusses the theoretical impact of globalization and digitalization on the Phillips curve. To fix ideas, we start our discussion with a brief overview of the New Keynesian Phillips curve framework that underlies our analysis:

$$\pi_t = \beta E_t \pi_{t+1} + \lambda r\hat{m}c_t + \eta_t \quad with \quad \lambda = \frac{(1-\theta)(1-\theta\beta)}{\theta}, \tag{1}$$

where, π_t, inflation in period t, is a function of $E_t\pi_{t+1}$, expected inflation in period $t+1$, $r\hat{m}c_t$, the deviation of real marginal costs (rmc_t) from their steady-state value (rmc) and η_t, an intercept. Moreover, the relationship between inflation and the deviation of real marginal costs from their steady state is governed by parameter λ, which in turn is a function of the price stickiness parameter θ (capturing the share of firms that do not adjust their prices in a period) and the discount factor β.

Based on this New Keynesian Phillips curve, we follow the framework proposed in Carney (2017), which highlights three groups of transmission channels through which globalization can affect the Phillips curve. First, globalization can affect the slope of the Phillips curve, λ; second, it can impact the intercept of the Phillips curve, η_t; and third, it can affect the amount of slack in the economy, which relates to $r\hat{m}c_t$.[5] Subsequently, we rely on the same groups of transmission channels to discuss the expected impact of digitalization on the Phillips curve.

2.1 Globalization and the Phillips Curve

The **slope channels** describe the impact of globalization on the sensitivity of inflation to cyclical changes in economic slack. In Equation (1), this sensitivity is measured by parameter λ. The literature on globalization and inflation focuses particularly on these channels and is broadly divided

[5]The second and third group of channels are also referred to as "the position *of* the Phillips curve" and the "economy's position *on* the Phillips curve," respectively.

into two strands.

The first strand describes the "globalization of inflation hypothesis." This hypothesis states that globalization has altered the drivers of inflation by reducing the relevance of traditional domestic determinants and by increasing the impact of foreign or global developments. One of the earlier studies to find a strong link between globalization and inflation in the context of this hypothesis is Borio and Filardo (2007). To test the globalization of inflation hypothesis empirically, the authors add proxies for global economic slack into the Phillips curves of 18 advanced economies. The results show that (i) measures of global economic slack add considerable explanatory power to the Phillips curve, (ii) this is especially the case since the 1990s, and (iii) in some cases, the impact of the global variables dominates the impact of the domestic output gap. Auer, Borio and Filardo (2017) build on this earlier work and argue that the expansion of global value chains is an important channel through which global economic slack influences domestic inflation. In particular, as global value chains expand, greater import competition for intermediate goods and services (direct channel) and greater entry threats at the various stages of the production process (indirect channel) make domestic inflation more sensitive to the global output gap.[6]

The extent to which other authors have confirmed the findings of Borio and Filardo (2007) varies. However, most studies find a lower significance of the foreign output gap in the Phillips curve framework and a weaker association with an increase of globalization than in Borio and Filardo (2007). Tootell (1998), for example, does not find a significant impact of a foreign output gap on US inflation.[7] Ihrig et al. (2010) find a significant impact of foreign slack on domestic inflation in 11 advanced economies, but many of the foreign output gap coefficients in their sample carry the wrong sign. Moreover, the authors find no evidence that the decline in the sensitivity of inflation to the domestic output gap relates to globalization. Finally, using a time-varying parameter vector autoregression (VAR), Bianchi and Civelli (2015) find that global slack does affect the dynamics of inflation in many of their 18 sample countries. However, the authors cannot confirm that the influence of global slack on inflation has become stronger over time.

The second strand of the literature examines the puzzling behavior of inflation during and after the global financial crisis. In particular, the literature identifies a "missing deflation puzzle" in the early post-crisis period (2009-11) and a "missing inflation puzzle" shortly after (from 2012 onward).

[6] Relatedly, Auer, Levchenko and Sauré (2019) document that international input-output linkages contribute substantially to the synchronization of producer price inflation across countries.

[7] See Ball (2006) and Mishkin (2008) for similar conclusions. Generally, it appears that studies focusing particularly on the US economy find no notable link between globalization and inflation.

While many explanations have been proposed to solve these puzzles, several of them involve a gradual flattening of the Phillips curve. If the Phillips curve has indeed flattened and this was related to an increase in globalization, a lower sensitivity of inflation to domestic slack might then have created the impression, consistent with the "globalization of inflation hypothesis," that inflation dynamics over the post-crisis period were disconnected from theory.[8]

WEO (2013), for example, presents estimates of unemployment-based, import-price-augmented Phillips curves with time-varying parameters for 21 advanced economies between the 1960s and 2012. Most strikingly, the study documents a gradual fall in the slope coefficient of the Phillips curve for both the median country in the sample and the interquartile range. Peaking at a value of close to 1.5 in 1975, the coefficient falls steadily over time and reaches almost zero at the end of the sample in 2012. Moreover, the analysis shows that the coefficient on import-price inflation has increased from a value below 0.5 in the early 2000s to a value of 2.0 at the onset of the global financial crisis. As both observations are generally consistent with the potential impact of an increase in globalization over time, the authors consider the latter a possible explanation. However, with respect to the observed flattening of the Phillips curve, the authors cite two additional explanations. First, inflation might have become simply better anchored around long-term expectations and thus less reactive to economic slack. Second, the existence of downward rigidities in nominal wages and nominal prices could have led firms to change wages and prices less frequently.

Finally, with a focus on firm-level channels, Carney (2017) argues that the globalization process induced firms to outsource (purchasing inputs from abroad) and offshore (producing products abroad) an increasing part of their production process to emerging markets to reduce production costs. For workers in advanced economies, these trends imply a loss of wage bargaining power and thus lower wage expectations, as firms could turn to foreign workers with lower wage demands.

Overall, the literature points to overwhelming evidence that globalization reduces the sensitivity of inflation to domestic slack. Consequently, we would expect the slope of the Phillips curve to become flatter when globalization is higher.

[8]For a detailed description of these puzzles and potential explanations, see Williams (2010); Ball and Mazumder (2011, 2014); Gordon (2013); WEO (2013); Murphy (2014); Coibion and Gorodnichenko (2015); Ferroni and Mojon (2015); Del Negro, Giannoni and Schorfheide (2015); Christiano, Eichenbaum and Trabandt (2015); Gilchrist et al. (2015); Blanchard, Cerutti and Summers (2015); Friedrich (2016); and Bobeica and Jarociński (2019).

The **intercept channels** focus on all impacts of globalization on the Phillips curve that are unrelated to cyclical changes in economic slack or the response of inflation to such changes. In Equation (1), these channels are associated with the intercept η_t.

Carney (2017) argues that these channels describe the one-off response of inflation to the integration of low-cost producers into the global economy. More specifically, the corresponding effects appear in the form of positive supply shocks that can affect both labor markets and final goods markets. Both effects are expected to shift the Phillips curve downward. For example, the increase in the global supply of labour has permanently reduced relative wages, particularly for low-skilled workers in advanced economies. This has consequently made the production of final goods cheaper. Moreover, this fall in production costs and the improved access of producers from emerging-market economies to final goods markets in advanced economies (e.g., China's accession of the World Trade Organization (WTO) in 2001) has increased competition and thus placed downward pressure on final goods prices.

Relatedly, Macklem (2014) refers to the disinflationary effects caused by increased competition as "good" disinflation because consumers benefit from lower prices, and increased competition is likely to lead to higher productivity in the future. We therefore expect more globalization to be associated with a fall in the intercept coefficient of the Phillips curve.

The **slack channels** cover the impact of globalization on inflation through cyclical changes in economic slack for a given slope and a given level of the Phillips curve. While various factors could be responsible for the dynamics of real marginal costs and thus economic slack, we focus our assessment on the role of employment. For simplicity, we discuss in this context both the short-term or cyclical effects on employment (in Equation (1) these effects are associated with variable rmc_t) as well as the long-term or trend effects on employment that determine the potential output of the economy (these are associated with variable rmc).[9]

In the short run, as suggested by Carney (2017) and others, changes in external demand can lead to adjustments in capacity utilization by domestic firms, and thus, have important implications for domestic labor markets. An increase in foreign demand, for example, would induce domestic firms to increase their production and thus hire more workers. Domestic employment would increase.

In the long run, employment is an important determinant of the economy's level of potential output. The emergence of corporate cost-saving practices, such as outsourcing and offshoring,

[9]Some of the long-run effects of employment have already been covered under the intercept channels.

could lead to changes in the labor force that affect potential output. In particular, outsourcing and offshoring increase the competition for the labor-intensive tasks of low-skilled and possibly also medium-skilled workers. By purchasing or producing the same inputs or outputs at a lower price abroad, internationally active companies weaken the bargaining power of domestic workers with these skill levels. Affected segments of the domestic labor force can then either accept a lower wage, attempt to change industries or transition into unemployment.

Not all workers have to be adversely affected by an increase in globalization, however. This is especially the case for high-skilled workers, who might benefit most from the creation of new jobs related to globalization (e.g., see Dauth et al., 2017). Examples of such newly created jobs are tasks related to the outsourcing or offshoring decisions themselves (e.g., monitoring international developments, managing international transactions) or tasks related to the modification of existing products to the global market (e.g., changes in product design, marketing). Hence, while composition effects are likely to be part of the story, the overall net impact of these opposing effects appears to be ambiguous, and thus, is an empirical question.

2.2 Digitalization and the Phillips Curve

The **slope channels** describe the impact of digitalization on the sensitivity of inflation to cyclical changes in economic slack (i.e., λ). At the core of this group of channels is the price setting process of firms and considerations of how digitalization can impact this process.

First, the increased use of digital technologies can reduce firms' costs to change their prices in response to changes in economic slack (the so called "menu costs"). These cost savings could stem from digital pricing technologies that simplify the price setting process across different locations in retail trade or for online retailers that need to input their price information only in a central location, for example. Second, firms could determine the optimal price faster and more accurately by applying digital technologies or exploring large-scale datasets that allow them to better forecast their future marginal costs and the expected demand for their products. Since both effects reduce price stickiness, and thus, the responsiveness of inflation to economic slack, we would expect that more digitalization increases the slope of the Phillips curve.

The **intercept channels** include all impacts of digitalization on the Phillips curve that are unrelated to cyclical changes in economic slack or to the response of inflation to such changes (i.e., η_t). The central element in this set of channels is the degree of competition among firms and their associated markups. In general, there are two lines of arguments on the impact of digitalization on competition.

The first suggests that digitalization reduces prices by facilitating the interaction and matching between producers and consumers. Sveriges Riksbank (2015), for example, states that the internet has increased the possibilities for customers to compare the price and the quality of goods. Moreover, e-commerce has opened up new markets, where firms are competing not only with their domestic competitors but also with firms in the same sector elsewhere in the world. As a result, digitalization could lead to an increase in competition between firms, and thus their market power would fall. This, in turn, would make it more difficult for firms to raise their prices.

The second points in the opposite direction. Charbonneau et al., (2017), for example, suggest that digital technologies can facilitate the emergence of dominant "superstar" firms that also possess considerable market power. Digitalization can help these firms to increase their market share at an early stage, which allows them to exploit network effects and positive returns to scale at later stages. Subsequently, such superstar firms can force traditional and smaller firms out of the market. Once they have established themselves as a monopolist, they can charge higher prices to extract consumer rents. Moreover, digitalization might promote technical solutions, such as copy protection methods or pay-wall access to digital content, which then support the extraction of monopolistic rents.

Finally, digitalization could impact inflation directly. For example, the decline in prices for hardware, software, and information and communications technology (ICT) might directly feed into inflation rates (e.g., see Sveriges Riksbank, 2015, and Charbonneau et al., 2017). Falling prices for such products could arise from a fall in production costs of electronics (e.g., computers and mobile phones) or from a transition from a physical to a digital distribution of products (e.g., newspapers and films). If prices of these components in the consumption basket fall, they are likely to have a negative impact on inflation as well. However, their overall share in the consumption basket is likely relatively small.

In summary, the effect of digitalization on the intercept channels can take many forms, with often opposing implications for inflation. Hence, we consider the overall effect of these channels on inflation as ambiguous.

The **slack channels** capture the impact of digitalization on inflation through cyclical changes in economic slack (i.e., rmc_t and rmc). However, most of the academic literature focuses predominantly on the impact of automation—a specific type of digitalization—on the labor market in the medium and long term. This focus is possibly a combination of the ability to measure automation directly (due to the availability of high-quality data on robot use) and the expectation that the effects of automation on the labor market have already started to materialize and are easier to detect than those of other types of digitalization. Three notable contributions in this area of the literature are Graetz and Michaels (2018); Acemoglu and Restrepo (2019); and Dauth et al. (2017).

Graetz and Michaels (2018) examine the impact of industrial robots on productivity growth at the industry level in 17 countries from 1993 to 2007. Their findings suggest that increased robot use has a positive impact on growth of labor productivity and total factor productivity. Moreover, the authors find that the increased use of robots lowers output prices while not significantly reducing total employment. The share of low-skilled workers' employment falls, however.

Acemoglu and Restrepo (2019) analyze the effect of the increase in industrial robot usage between 1990 and 2007 on US labor markets. They present a model in which robots compete against workers, such that advances in robotics technology may reduce employment and wages. The authors' empirical analysis then finds a negative effect of robots on employment and wages. Specifically, one more robot per thousand workers is estimated to reduce the employment-to-population ratio by about 0.2 percentage points and reduce wages by 0.42 percent.

Dauth et al. (2017) examine the effect of robots on employment, wages, and the composition of jobs in German labor markets between 1994 and 2014. The authors find that the adoption of industrial robots has no effect on total employment. There are some distributional effects, however, as robot adoption leads to job losses in the manufacturing sector that are offset by gains in the business service sector. Moreover, they find that robot adoption does not increase the risk of displacement for incumbent manufacturing workers, as the loss of manufacturing jobs is driven by fewer new jobs for young labor market entrants.

In addition, Charbonneau et al. (2017) note that digital technologies can also be of labour-augmenting nature and thus potentially increase labor demand in the economy. This, however, would apply mostly to high-skilled workers associated with the development, distribution, or operation of such technologies, and less to the economy as a whole.

Findings across the literature appear to be mixed regarding the overall effect of digitalization (or automation) on employment since only Acemoglu and Restrepo (2019) find a notably negative effect. However, similar to globalization, there appears to be a considerable distributional impact of digitalization for workers in advanced economies that comes at the disadvantage of those with little formal education and low skill levels.

3 Estimation of Industry-Level Phillips Curve

This section describes the estimation of the industry-level Phillips curves, whose coefficient estimates will serve as dependent variables in our empirical analysis in Section 4. We first describe the underlying industry-level data, we then introduce the Phillips curve specification, and finally, we present the results from estimating the Phillips curve specification on the data.

3.1 Industry-Level Data

We use data from the KLEMS database to estimate Phillips curves at the industry level for our sample of 18 advanced economies.[10] The KLEMS datasets feature internationally consistent data on output, factor inputs and productivity at the industry level over time. To cover a broad sample of countries, we combine data from the European Union (EU) KLEMS database (which includes data for all 28 EU member states as well as data for the United States) with data for Canada and Japan from the World KLEMS database.[11] We rely on the 2017 release of the EU KLEMS dataset, the 2012 release of Canadian KLEMS dataset and the 2013 release of the Japanese KLEMS dataset. Their industry structure and coverage are as follows:

- The 2017 release of the EU KLEMS dataset is largely based on the NACE 2 industry classification, which is consistent with the fourth revision of the International Standard Industrial Classification (ISIC Rev. 4). For most countries, the EU KLEMS dataset covers 34 industries and ranges from 1995 to 2015.[12]
- The 2012 release of the Canada World KLEMS dataset is based on the NAICS 2007 classification, covers 31 industries and ranges from 1961 to 2008.

[10] KLEMS stands for analysis of the production factors capital (K), labour (L), energy (E), materials (M) and service (S).

[11] The EU KLEMS database is produced by the Conference Board and funded by the European Commission. The data for Canada and Japan are part of the World KLEMS database, which has been created in partnership with Statistics Canada and the Research Institute of Economy, Trade and Industry (RIETI) of Japan, respectively.

[12] Moreover, the EU KLEMS database is consistent with the new European System of National Accounts "ESA 2010" and the data on output, value added, employment, gross fixed capital formation, prices and capital stock are consistent with national accounts data from Eurostat at the corresponding industry levels.

- The 2013 release of the Japan World KLEMS dataset is based on the third revision of the International Standard Industrial Classification (ISIC Rev. 3.1), covers 108 industries and ranges from 1970 to 2009.

To make these data from different sources compatible, we adjust the Canadian and Japanese industry structures to match those of the EU KLEMS data. In this process, we follow as close as possible the concordance tables for the conversion of ISIC Rev. 3.1 to ISIC Rev. 4 in Annex D of OECD (2012). The Canadian data include their own concordance table, which aligns Canada's industries with their EU KLEMS equivalents. We then select our final set of industries at the lowest aggregation level in the ISIC Rev. 4 data. Table 1 presents the list of industries included in our empirical analysis.

To estimate the industry-level Phillips curves, we rely on the following variables derived from the original KLEMS variables:

Gross Output Inflation: Gross Output Inflation is the key variable of our empirical analysis and represents the dependent variable in the Phillips curve. It is calculated for each industry in each country as the year-over-year growth rate in the Price of Gross Output, an index with the base year in 2010. Unfortunately, only a subset of countries in the EU KLEMS database report data on gross output, which reduces the number of EU countries that we can include in our sample.

Figure 2 plots, for the United States, our self-computed gross output inflation variable from the KLEMS dataset for the "All Industries" aggregate against annual consumer price inflation at the country level from the April 2019 World Economic Outlook (WEO) database. Both series align very well, which suggests that the industry data are representative of their country-level equivalents.

Employment Gap: We compute industry-specific employment gaps as the deviation of employment from its trend. Employment is measured as the number of employees per industry (in thousands) and the trend is extracted with a two-sided Hodrick Prescott (HP) filter.[13]

Figure 3 plots, again for the United States, the KLEMS employment variable for the "All Industries" aggregate against employment at the country level from the April 2019 WEO database. The comparison starts in the year 2000, since KLEMS data on employment are not available for the United States before this date. Again, both series align very well, also suggesting here that the

[13] Central banks often have different ways of measuring slack. For recent evidence from the Bank of Canada, for example, see Brouillette et al. (2021).

industry data are representative of their country-level equivalents.

Overall, we estimate individual Phillips curves for 33 industries in 18 countries.[14] We face a trade-off between selecting a shorter and a longer estimation sample. If the sample is too short, the Phillips curves are based on only a few data points and thus potentially estimated imprecisely. If the sample is too long, however, it is more difficult to meaningfully assess the impact of globalization and digitalization on the Phillips curve, as all variation in the Phillips curve coefficients comes from the country or industry dimension but not from the time dimension. Given that the EU KLEMS data are available for most countries between 1995 and 2015, we opt for the estimation of two non-overlapping Phillips curves per country-industry pair that range from 1996 to 2005 and from 2006 to 2015 and thus each covers a decade of data.

3.2 Phillips Curve Specification

We estimate the following empirical Phillips curve specification for each industry:

$$\Delta price_{c,i,t} = \alpha + \beta empgap_{c,i,t} + \gamma \Delta price_{c,i,t-1} + \varepsilon_{c,i,t}, \tag{2}$$

where $\Delta price_{c,i,t}$ is the year-on-year growth rate in the price of gross output (i.e., gross output inflation) in industry i of country c in year t, $empgap_{c,i,t}$ is the employment gap of the corresponding country-industry-year observation, and $\Delta price_{c,i,t-1}$ is the lagged inflation rate as a proxy for inflation expectations (inflation expectations are backward-looking in this case). We are particularly interested in the following three components of the Phillips curve. First, the slope coefficient β that describes the sensitivity of inflation to economic slack, measured by the employment gap. Second, the intercept coefficient α that describes the position *of* the Phillips curve in the inflation-employment space, which captures all factors that impact inflation through channels other than economic slack or inflation expectations. Finally, we use the natural logarithm of employment to capture the economy's position *on* the Phillips curve. We prefer employment in levels over the employment gap to facilitate the interpretation of this variable. All three components of interest, the slope coefficients, the intercept coefficients, and the natural logarithm of employment, are winsorized at the 1 percent level on both sides of the distribution across industries.

[14] The countries are Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Italy, Japan, Netherlands, Portugal, Romania, Slovak Republic, Slovenia, Sweden, and the United States.

We follow Carvalho et al. (2019) and estimate our Phillips curves by ordinary least squares. All standard errors are heteroskedasticity robust.

3.3 Phillips Curve Results

We proceed in two steps. First, we validate our Phillips curve specification by estimating a set of Phillips curves only for the United States. We then apply our preferred specification to the entire sample of industry-level data from 18 countries.

3.3.1 Phillips Curve Validation

Before we turn to the industry-specific Phillips curves, we demonstrate the robustness of our data and Phillips curve specification choices. We conduct this analysis based on the Phillips curve for the United States over the full sample over which data are available (i.e., 2000 to 2015). We focus on two exercises, the first to validate our choice of industry-level data and the second to validate our choice of the Phillips curve specification.

First, Figure 4 compares the US KLEMS Phillips curve for the "All Industries" sector, as shown in Equation (2), with a corresponding Phillips curve estimated based on country-level data from the April 2019 WEO database.[15] We observe that the two Phillips curves align relatively well, which validates our data choice.

Second, Figure 5 compares the same US KLEMS Phillips curve based on backward-looking inflation expectations to two alternatives, one based on forward-looking inflation expectations from Consensus Economics data[16] and the other based on a mix of backward- and forward-looking inflation expectations. As Figure 5 shows, the three Phillips curves line up relatively well and all have a positive slope. Moreover, the Phillips curve with backward-looking inflation expectations is located in the middle between the curve with forward-looking expectations and the curve with a mix of both. Since we do not have data on forward-looking inflation expectations at the industry level, and we thus have to resort to backward-looking inflation expectations instead, this observation is good news, as the potential "error" of not including forward-looking inflation expectations is

[15] We select the following variables from the WEO database. We use "Inflation: Average consumer prices, percent change" as a measure of inflation and "Employment: Persons, millions" as a measure of employment. We first construct an output gap from the employment variable based on a two-sided HP filter. We then regress inflation on lagged inflation and the self-constructed employment gap.

[16] Consensus Economics forecasts for inflation are available at monthly frequency for the current and the next calendar year. To obtain a 12-month out series of inflation expectations, we construct a weighted average of the forecasts for the two respective years. We then use this series to replace backward-looking inflation expectations in the US KLEMS Phillips curve.

relatively small.

3.3.2 Industry-level Phillips Curves

We now turn to the estimation of the industry-level Phillips curves. We obtain these Phillips curves by estimating Equation (2) for each country-industry combination over the decades starting in 1996 and 2006, respectively. Figures 6 to 8 present the distribution of their slope coefficients, their intercept coefficients, and the log values of the underlying employment variable in our sample. To reduce the impact of outliers, we winsorize all three distributions at the 1st and 99th percentile. We will briefly discuss each of the three distributions.

Figure 6 presents the results for the sample distribution of the slope coefficients. The winsorized slope coefficients range from -4.4 to +4.2 with a median value of 0.07. Moreover, most data points are located around or slightly above zero. This observation represents the long-standing fact that Phillips curves in many countries have flattened over the years (e.g., WEO, 2013).

Figure 7 displays the corresponding sample distribution of the intercept coefficients. The winsorized distribution ranges from -5.7 to +19.1 with a median value of 1.5. The main mass of the distribution is located between 0 and 5. This suggests that even for a balanced employment gap, inflation in most sectors is positive.

Finally, Figure 8 shows the sample distribution of the natural logarithm of employment. Most of the distribution's mass appears to be located between the log values of -0.9 and +10.0, with a small set of large industries reaching log values of up to 15.

To conclude, in this section, we have estimated two industry-level Phillips curves for each country-industry pair of our sample, one for the decade starting in 1996 and another one for the decade starting in 2006. Overall, these Phillips curves appear to be based on representative data, a robust specification choice, and the distribution of their resulting coefficient estimates appears to be in line with prior expectations.

4 The Impact of Globalization and Digitalization

This section introduces the empirical methodology of our main analysis and discusses how we measure globalization and digitalization. We then present our main results that illustrate how globalization and digitalization impact the slope coefficient of the Phillips curve.

4.1 Empirical Methodology

4.1.1 Empirical Specification

First, we estimate the following specification to assess the aggregate impact of globalization and digitalization on the Phillips curve:

$$pkvar_{c,i,d} = \alpha + \alpha_c + \alpha_i + \alpha_d + \beta global_{c,d} + \gamma digital_{c,d} + \varepsilon_{c,i,d}, \quad (3)$$

where $pkvar_{c,i,d}$ takes on—for each industry i, country c, decade d combination—one of the following: (i) the slope coefficient of the Phillips curve, (ii) the intercept coefficient of the Phillips curve, or (iii) the natural logarithm of the corresponding employment variable. The variables $global_{c,d}$ and $digital_{c,d}$ are our measures of globalization and digitalization in this specification. Moreover, we include a series of fixed effects into our specification to absorb confounding factors: α, α_c, α_i, and α_d are the regression constant and sets of country, industry and decade fixed effects, respectively. While country fixed effects capture the impact of all factors that are constant within countries over time, industry fixed effects absorb all industry-specific influences that are time-invariant, and decade fixed effects control for all factors that affect countries and sectors in the same way at each point in time.

After establishing the aggregate impact of globalization and digitalization on the Phillips curve, we examine different transmission channels through which these aggregate effects could materialize. We rely on the following specification to test these transmission channels:

$$\begin{aligned} pkvar_{c,i,d} &= \alpha + \alpha_c + \alpha_i + \alpha_d + \mu global_{c,d} \times channel_{c,i,d} + \delta digital_{c,d} \times channel_{c,i,d} \\ &\quad + \beta global_{c,d} + \gamma digital_{c,d} + \theta channel_{c,i,d} + \varepsilon_{c,i,d} \quad (4) \end{aligned}$$

Equation (4) resembles Equation (3) but now includes two interaction terms between the globalization and digitalization variables, on one hand, and a variable $channel_{c,i,d}$ that represents potential transmission channels for both trends, on the other hand. We also include the corresponding level terms for $global_{c,d}$, $digital_{c,d}$, and $channel_{c,i,d}$ individually. We evaluate this equation by calculating the marginal effects of both trends, which are now a function of the values of the channel variable. For example, for our measure of globalization, the marginal effect on the Phillips curve takes on the following form:

$$\frac{\partial pkvar_{c,i,d}}{\partial global_{c,d}} = \mu channel_{c,i,d} + \beta \tag{5}$$

After having stated our empirical specification, we now discuss the underlying data for the empirical estimation.

4.1.2 Data

We use the following data sources in this section of the paper.

Slope of the Phillips Curve: Our dependent variable is the vector of *slope* coefficients of the industry-level Phillips curves that were created in Section 3.3.2. In our analysis, we use the winsorized version of these coefficients in which we replace all values below the 1^{st} percentile with those of the 1^{st} percentile and all values above the 99^{th} percentile with those of the 99^{th} percentile. The distribution of this variable is shown in Figure 6.

Globalization: We measure globalization at the country level with the index for Overall Economic Globalisation from the KOF Swiss Economic Institute. This index combines data from four sub-indices on de facto trade globalization, de jure trade globalization, de facto financial globalization, and de jure financial globalization. The four sub-indices in turn are composed of the following variables: trade in goods, trade in services, trade partner diversity (de facto trade globalization index), trade regulations, trade taxes, tariffs, trade agreements (de jure trade globalization index), foreign direct investment, portfolio investment, international debt, international reserves, international income payments (de facto financial globalization index), investment restrictions, capital account openness and international investment agreements (de jure financial globalization index). The overall economic globalization index is then constructed by aggregating the four sub-indices and assigning each of them a weight of 25 percent. All index data are normalized by transforming each underlying variable onto a scale from 1 to 100. In each case, a value of 100 is assigned to the maximum value of a specific variable over the entire country sample and the entire time range of the KOF index.[17] To ensure stationarity of the globalization variable in our empirical analysis, we convert the index for Overall Economic Globalisation into the percentiles of its own distribution.

[17]For more details, such as the weights of the individual variables within the sub-indices and the procedure of handling missing data, see KOF (2018a) and KOF (2018b), respectively

Digitalization: We measure digitalization at the country level with the operational stock of industrial robots as a share of the total population of a country (in millions). Data on industrial robots come from the International Federation of Robotics (IFR) and measure the deliveries of "multipurpose manipulating industrial robots." The definition of industrial robots was created by the International Organization for Standardization (ISO) and is consistent across countries, industries, and decades.[18] We make two modifications to the original data. First, robots from the United States and Canada are reported jointly over parts of the sample. To separate the two, we assign their respective shares in the first year in which their individual data are available to all previous years. Second, the definition of robots in Japan is broader that in any other country and thus the number of robots in Japan is very high. To be able to include Japan in our sample, we apply the growth rate of Japanese robots to the level of robots in Germany, the country with the second highest number of robots in the sample, in the first year in which both, Japanese and German data are available. Data on countries' total population are taken from the April 2019 WEO database. As with globalization, we include the digitalization variable based on its own distribution percentiles in our empirical analysis to ensure stationarity.

Data on Transmission Channels: We use data on total factor productivity growth (TFP Growth) and the growth rate of the stock of investments in Information Technology (IT Growth) from the KLEMS database. For both variables, we rely on the annual growth rate in the first year of each decade to reduce endogeneity concerns.

We do not include additional control variables in the regressions because globalization and digitalization have a relatively high correlation with standard control variables in country-level regressions. Hence, the inclusion of additional controls could result in muticollinearity concerns. For example, the correlation of globalization and institutional quality amounts to around 0.7 and the correlation between digitalization and stock market capitalization amounts to about 0.6.

[18] See Graetz and Michaels (2018). More explicitly, the authors quote the ISO definition of a robot, "An automatically controlled, reprogrammable, multipurpose manipulator programmable in three or more axes, which may be either fixed in place or mobile for use in industrial automation applications."

4.2 Results

4.2.1 Aggregate Results

We start with an assessment of the aggregate effects of globalization and digitalization on inflation. Hence, at this stage, we do not yet consider the various transmission channels through which both trends could affect the slope of the Phillips curve. Table 2 presents these aggregate results from estimating Equation (3) for the slope coefficient of the Phillips curve, obtained in Section 3, on our sample of 18 countries over the two decades covering the period 1996 to 2015.

Specification (1) presents the aggregate effect of globalization on the slope of the Phillips curve without controlling for digitalization or any of the fixed effects. The resulting coefficient on the globalization variable amounts to -0.0025 and is statistically significant at the 10 percent level. Therefore, an increase in the index of economic globalization reduces the slope of the Phillips curve. This result mirrors one of the key predictions of the theoretical channels discussed in Section 2, which suggests that certain components of the globalization process, such as offshoring and hiring foreign workers (and the associated loss of bargaining power for domestic workers) reduce the sensitivity of domestic inflation to domestic slack.

Specification (2) shows, in a corresponding way, the aggregate effect of digitalization on the slope of the Phillips curve without controlling for globalization or any fixed effects. For digitalization, we observe a positive, but statistically insignificant coefficient. This result could be related to the fact that several of the transmission channels associated with digitalization carry opposing signs and thus may offset each other. Another possibility is that the effect of digitalization is in fact positive, but the exclusion of the globalization variable from the regression, which, based the result from Specification (1), pushes the slope of the Phillips curve downwards, produces an omitted variable bias. The next specification will be able to provide an answer to whether the second interpretation is a possible alternative.

Specification (3) includes measures of both, globalization and digitalization in the regression. Two observations emerge. First, the effect of globalization not only remains negative, it even falls slightly to a value of -0.0034 and is statistically significant at the 5 percent level. Second, once we control for globalization in the regression, the positive effect of digitalization increases in magnitude, amounts to 0.0027 and is significant at the 5 percent level as well. This observation suggests that, of the transmission channels outlined in Section 2, those that predict a positive impact of digitalization on the slope of the Phillips curve appear to dominate those that suggest a negative impact. Examples of such channels are the increased use of digital technologies that could reduce firms' menu costs or that could help firms determine their optimal prices faster and more accurately. Both channels would lead to a higher sensitivity of inflation to economic slack.

Specifications (4) to (6) demonstrate the robustness of our results under increasingly stricter sets of fixed effects. Specification (4) adds country fixed effects to Specification (3). Country fixed effects control for all confounding factors that are country-specific and that are the same across industries and over time. This could include both structural factors (e.g., institutional quality, nature of the pension system or coverage of unemployment insurance) as well as cultural factors (e.g., willingness to negotiate a higher wage, to go on a strike, or to change jobs) that are very persistent but could potentially confound the comparability of Phillips curve coefficients across countries. As the results from Specification (4) show, the effects of globalization and digitalization are even more pronounced, with the coefficient of globalization almost doubling in size and amounting to -0.0093 (significant at the 5 percent level) and the coefficient of digitalization increasing to 0.0087 (significant at the 1 percent level).

In a similar way, Specification (5) adds both country and industry fixed effects to the regression. Industry fixed effects account for all factors that are industry-specific and that do not vary across countries or over time. Such factors could include industry-specific labor market arrangements (e.g., the willingness of workers in an industry to join a union) and industry-specific goods market features (e.g., the frequency of sector-specific pass-through of input price shocks into final goods prices). Overall, the coefficients of the globalization and the digitalization variables are stable and remain statistically significant.

Finally, Specification (6) includes country, industry, and decade fixed effects. Decade fixed effects control for all factors that are decade-specific and do not vary across countries or across industries. Typical examples of such factors are global economic events (e.g., the impact of the global financial crisis), or changes in economic policies (e.g., the use of quantitative easing (QE) by central banks or banking sector bailout packages by governments) as well as other global trends that do not work through the same channels as globalization and digitalization (e.g., climate change). Therefore, by including three sets of fixed effects, Specification (6) absorbs a wide range of confounding factors and thus is the most robust specification in our analysis. Moreover, Specification (6) corresponds exactly to Equation (3) and thus serves as our baseline specification. Turning to the coefficient estimates, we observe a value of -0.0089 for globalization and a value of 0.0108 for digitalization, the former statistically significant at the 10 percent level and the latter at the 1 percent level. Hence, our baseline specification that examines the impact of both trends on the slope of the Phillips curve suggests that globalization reduces the slope and digitalization increases it.

Next, we turn to the intercept results. Table 3 presents the results for the intercept of the Phillips curve in the same way as the previous table presented the slope coefficients. The six specifications contain increasingly stronger sets of fixed-effect structures, rendering Specification (6), which includes country, industry, and time fixed effects, the most robust specification. As can be seen from this table, the impact of an increase in globalization (i.e., increasing the percentile of the distribution) leads to a lower intercept coefficient. This is consistent with the interpretation that channels unrelated to changes in economic slack (including the response of inflation to such changes), such as the integration of low-cost producers into the global economy, are at play here. While the results for globalization are very stable across specifications, the results for digitalization change sign between Specifications (3) and (4). The inclusion of country fixed effects, in particular, changes the negative impact of an increase in digitalization to a positive impact of this variable. In the richer and thus more robust economic specifications, Specifications (4)-(6), we observe that an increase in digitalization increases the intercept coefficient, shifting the Phillips curve upward.

Finally, Table 4 presents the results of changes in globalization and digitalization on the level of employment (measured through its natural logarithm). While we find negative and significant effects for globalization in the specifications without fixed effects, the coefficient turns insignificant for specifications with stricter sets of fixed effects. A similar observation can be made for digitalization, where the specifications without fixed effects indicate a positive and significant impact of digitalization on employment, but the more robust specifications do not show a significant effect.

4.2.2 Transmission Channels

In the next step, we examine more closely the transmission channels through which globalization and digitalization affect the slope of the Phillips curve.[19] Table 5 presents these results. All three specifications in this table contain the strictest set of country, industry, and decade fixed effects from our baseline specification. Moreover, Specification (1) in this table corresponds to our baseline specification (i.e., Specification (6) in Table 2) and has been added for comparison.

Specification (2) examines the interactions of globalization and digitalization with the growth

[19] We leave the assessment of the impact of globalization and digitalization on the Phillips curve intercept and employment to future research.

rate of total factor productivity (TFP Growth) and thus tests whether TFP growth is a potential transmission channel for the impact of these trends on the slope of the Phillips curve. To reduce endogeneity concerns, our measure of TFP growth is taken from the first year of each decade (i.e., at a time before the impacts of globalization and digitalization, which are both measured as average values over each decade, can materialize). Starting from the top of the table, we observe that the direct effects of globalization and digitalization on the slope of the Phillips curve are negative and positive, respectively. Although not statistically significant, their signs correspond to those in the baseline specification (Specification (1)). Turning to the interaction effects between globalization and digitalization one the one hand, and TFP growth on the other hand, we observe a positive and significant coefficient on the interaction term between globalization and TFP growth. This positive interaction term suggests that the negative effect of globalization on the slope of the Phillips curve is less negative when the initial level of TFP growth in an industry is high. Possible interpretations for this finding are that industries with high TFP growth may be reluctant to modify their existing production processes through outsourcing or offshoring. Moreover, there might be an association between TFP growth and tasks that are difficult to outsource or offshore in the first place, such as research and development.

Specification (3) shows the interactions between globalization and digitalization and the growth rate of the stock of investments in information technology (variable: IT Growth). Again, we find the familiar pattern for the direct effects that are negative for globalization and positive for digitalization (this time, both significant at the 5 percent level). When focusing on the interaction terms, we observe that the interaction between digitalization and IT investment growth is negative and significant. This suggests that the positive impact of an increase in digitalization on the slope of the Phillips curve is less positive for industries that have experienced high levels of IT investment in the past. Potential explanations for this finding are that the existing capital stock is still productive (i.e., consistent with an interpretation that IT capital and industrial robots are substitutes) or that a high level of IT investment has increased labor productivity and thus reduced the need to automate certain tasks (i.e., consistent with an interpretation that labor and industrial robots are substitutes).

Overall, this section has shown that TFP growth and IT investments may be potential transmission channels that highlight conditions under which globalization and digitalization affect the slope of the Phillips curve and thus the responsiveness of inflation to economic slack. The tests described, however, are merely illustrative and more research is needed to explore additional channels.

5 Conclusion

In this paper, we examine the impact of globalization and digitalization on the Phillips curve in a sample of 18 advanced economies over two decades. Our findings from the analysis of aggregate effects suggest that globalization significantly reduces the slope of the Phillips curve and digitalization has the opposite effect. We also provide some evidence that globalization decreases the intercept of the Phillips curve and that digitalization increases it. Evidence for the impact of both trends on the natural logarithm of employment is less conclusive. When investigating the associated transmission channels for both trends in the context of our slope analysis, we find that the negative impact of globalization on the slope coefficient of the Phillips curve is muted in industries that experience a high growth rate of TFP, and that the positive impact of digitalization is muted in industries that have seen high investments in IT capital in the past.

While this analysis is a first attempt to address the important question of how globalization and digitalization affect inflation dynamics, seen through the lens of the Phillips curve, it has a number of caveats—in particular, in the context of measuring digitalization, the newer of the two trends.

First, our measure of industrial robots captures only a subset of digitalization (albeit a very important one), which is the result of a limited availability of digitalization measures that are consistently defined across countries and feature a sufficiently long time dimension. However, the literature on measuring digitalization is growing fast and recent work offers a rich set of alternatives (e.g., Anderton et al., 2020).

Second, there are considerable challenges associated with including digitalization measures in the empirical analysis. We resorted to converting the levels of industrial robots per capita into distribution percentiles to work with a stationary variable. However, many other alternatives are plausible and their implications for the economic results can be sizable. Using growth rates instead of levels to construct the distribution percentiles produces material changes in the distribution of digitalization across countries, for example. The reason for this is that countries with low levels of industrial robots have high growth rates, and vice versa.[20]

Third, with TFP and IT capital, we have examined two important transmission channels of the impact of globalization and digitalization on the Phillips curve, but the list of possible alternative

[20]Moreover, from a theoretical perspective it is not clear whether levels or growth rates of digitalization should impact the Phillips curve.

transmission channels is long. In particular, education, skill levels, and routine tasks are possible explanations that could modify the impact of both globalization and digitalization on the Phillips curve.

And fourth, with the emergence of COVID-19, both globalization and digitalization have experienced changes in their trajectory and are likely to see even more changes in the future. Conducting this or a similar analysis with the particular consideration of recent changes that the pandemic has brought to certain industries opens up a wealth of future research questions.

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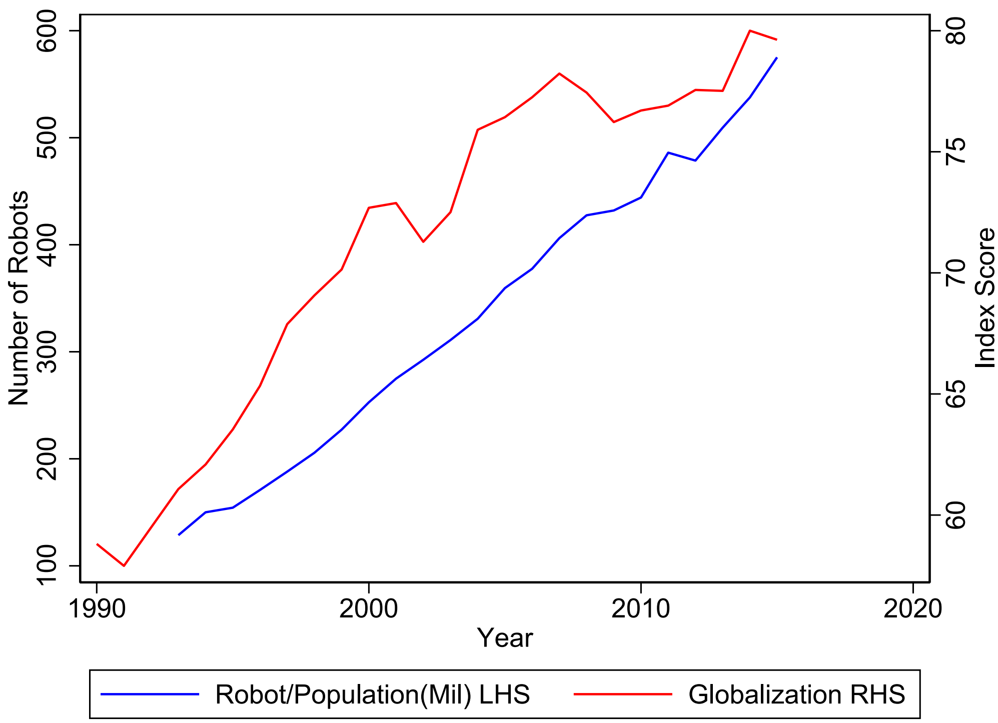
7 Appendix

7.1 Figures and Tables

7.1.1 Figures

Figure 1: The Dynamics of Globalization and Digitalization



Notes: In this figure, globalization is measured by an index for Overall Economic Globalisation from the KOF Swiss Economic Institute. Digitalization is measured by the operational stock of industri-
al robots from the International Federation of Robotics (IFR) as a share of the total population of a country. For more details on the data, see Section 4.1.2. LHS = Left-hand side; RHS = Right-hand side.

Figure 2: Comparison of Inflation in KLEMS Data and WEO Data

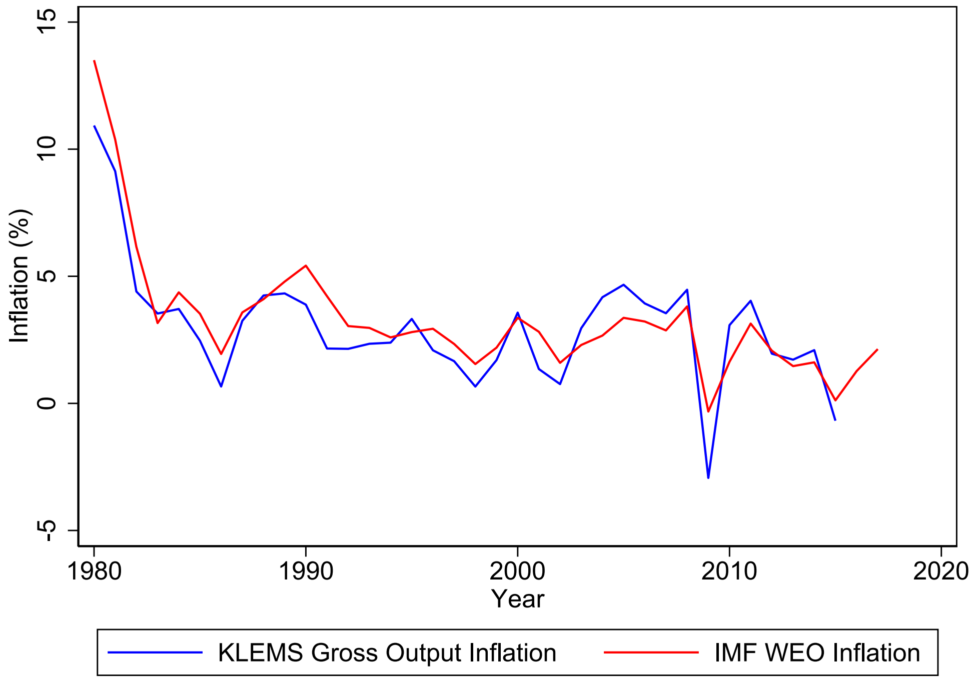


Figure 3: Comparison of Employment in KLEMS Data and WEO Data

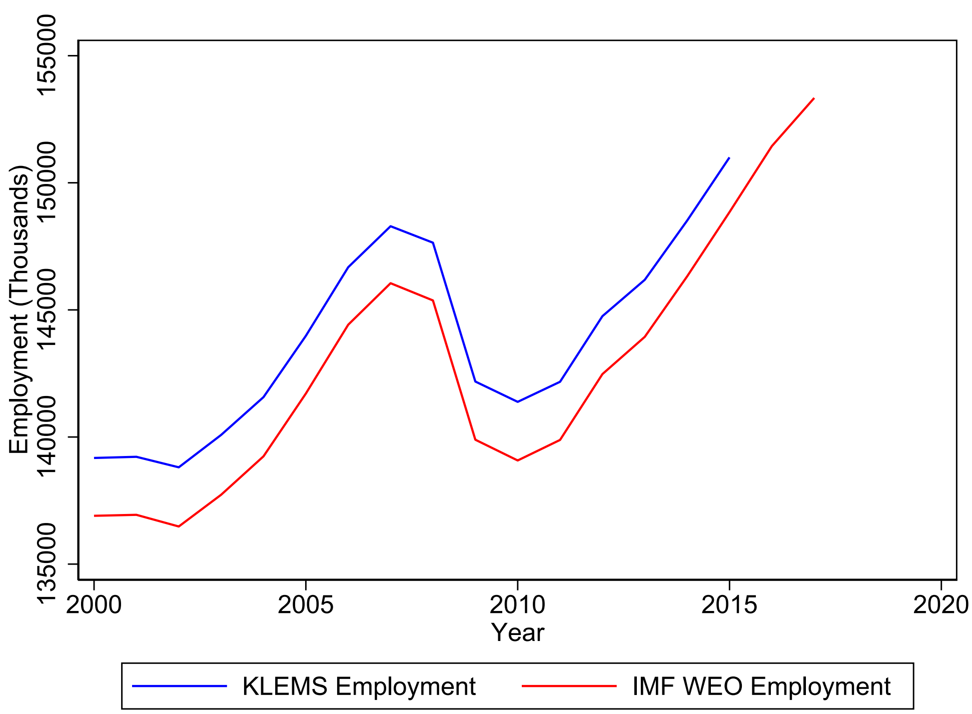


Figure 4: Comparison of Phillips Curves in KLEMS Data and WEO Data

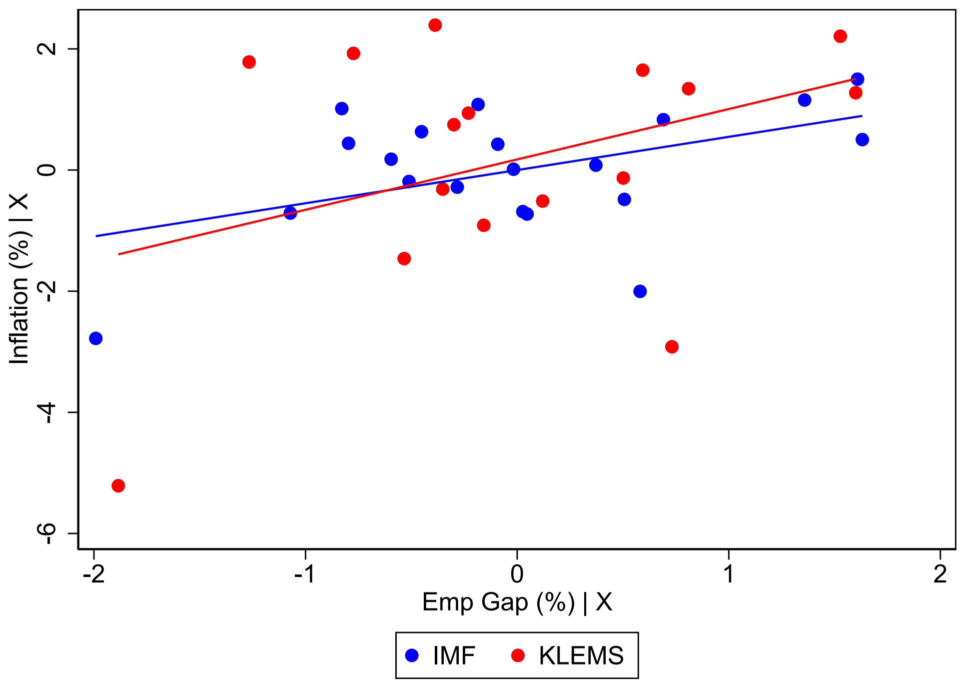


Figure 5: Comparison of Inflation Expectations in KLEMS Data

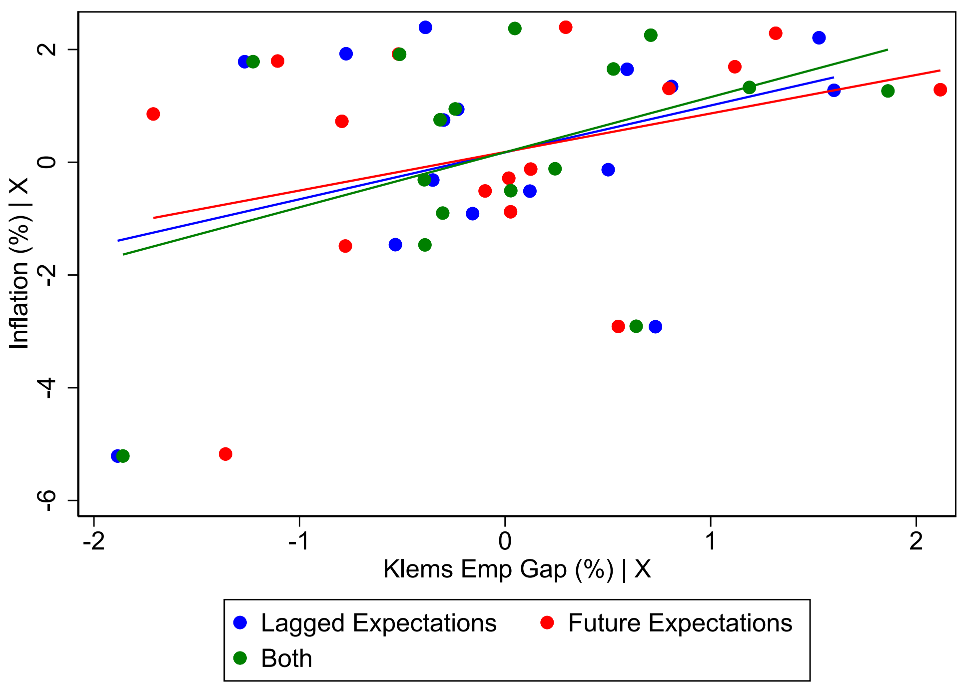


Figure 6: The Sample Distribution of Phillips Curve (PK) Slope Coefficients

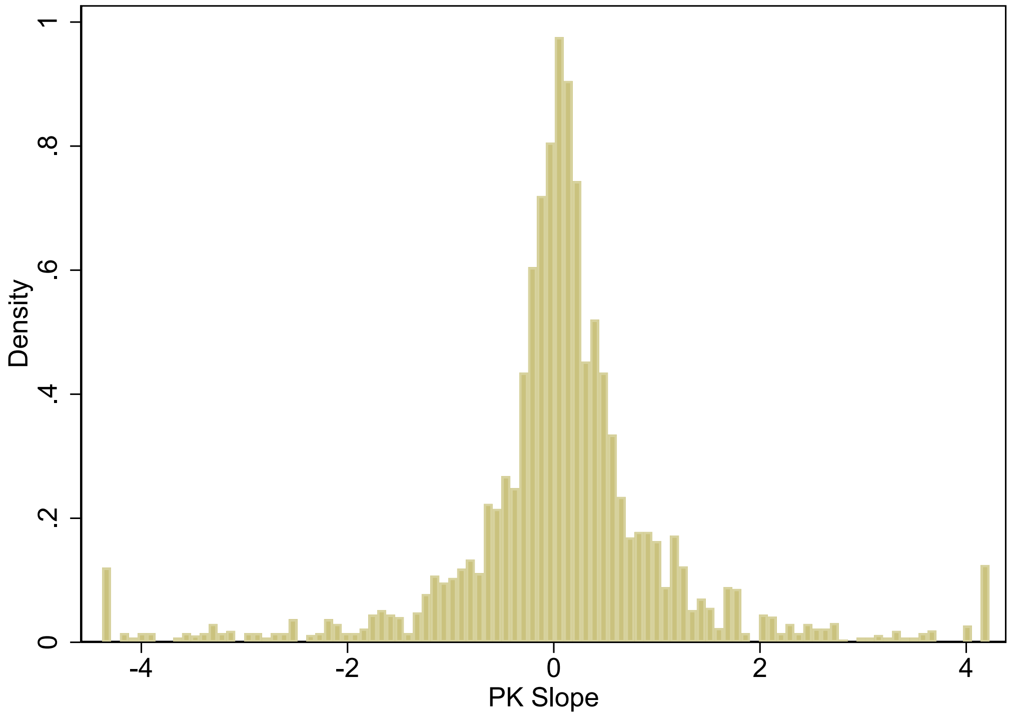


Figure 7: The Sample Distribution of Phillips Curve (PK) Intercept Coefficients

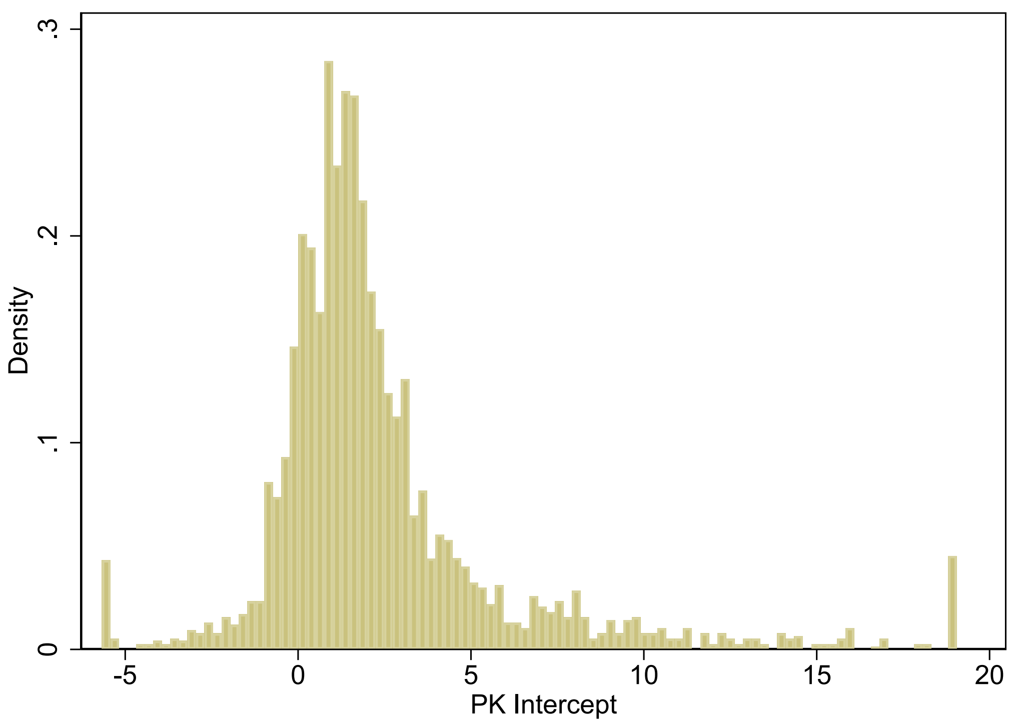
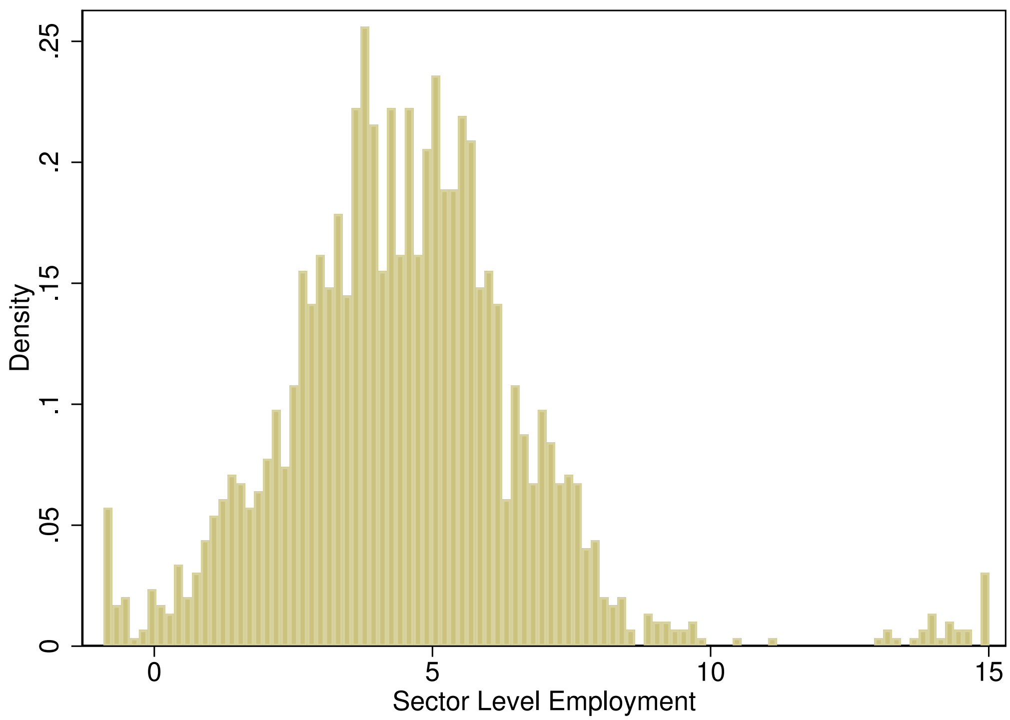


Figure 8: The Sample Distribution of Log Employment



7.1.2 Tables

Table 1: Industries Included in the Sample

Industry Name
Agriculture
Car Trade
Chemicals
Construction
Education
Electrical Equipment
Electricity
Entertainment
Financial
Food
Health
Housework
Information Technology
Machinery
Metals
Mining
Other Manufacturing
Other Services
Paper
Petroleum
Plastics
Postal
Professional Services
Public Administration
Publishing
Real Estate
Retail Trade
Telecom
Textiles
Tourism
Transport Equipment
Transportation Storage
Wholesale Trade

Table 2: Aggregate Effects of Globalization and Digitalization on the Slope Coefficient of the Phillips Curve

PK Slope	(1)	(2)	(3)	(4)	(5)	(6)
Globalization	-0.0025*		-0.0034**	-0.0093**	-0.0093**	-0.0089*
	(0.001)		(0.001)	(0.005)	(0.004)	(0.005)
Digitalization		0.0015	0.0027**	0.0087***	0.0087***	0.0108***
		(0.001)	(0.001)	(0.003)	(0.003)	(0.004)
Country FE	No	No	No	Yes	Yes	Yes
Industry FE	No	No	No	No	Yes	Yes
Decade FE	No	No	No	No	No	Yes
R2	0.00	0.00	0.01	0.05	0.10	0.10
Observations	1104	1104	1104	1104	1104	1104
Countries	18	18	18	18	18	18

Note: The dependent variable of all regressions in this table is the slope coefficient of the Phillips curve (PK Slope). It corresponds to coefficient β in Equation (2) and has been estimated in Section 3.3.2. The definitions of all variables shown in this table, including for the measures of globalization and digitalization, are given in Section 4.1.2. We exclude the Romanian industry "Other Services" as it constitutes an outlier. Heteroscedasticity robust standard errors are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A constant is included but not shown. FE = Fixed Effects.

Table 3: Aggregate Effects of Globalization and Digitalization on the Intercept Coefficient of the Phillips Curve

PK Intercept	(1)	(2)	(3)	(4)	(5)	(6)
Globalization	-0.0343***		-0.0222***	-0.1464***	-0.1464***	-0.1431***
	(0.005)		(0.004)	(0.014)	(0.014)	(0.014)
Digitalization		-0.0432***	-0.0357***	0.0457***	0.0457***	0.0619***
		(0.004)	(0.004)	(0.008)	(0.008)	(0.012)
Country FE	No	No	No	Yes	Yes	Yes
Industry FE	No	No	No	No	Yes	Yes
Decade FE	No	No	No	No	No	Yes
R2	0.08	0.13	0.16	0.48	0.54	0.54
Observations	1104	1104	1104	1104	1104	1104
Countries	18	18	18	18	18	18

Note: The dependent variable of all regressions in this table is the intercept coefficient of the Phillips curve (PK Intercept). It corresponds to coefficient α in Equation (2) and has been estimated in Section 3.3.2. The definitions of all variables shown in this table, including for the measures of globalization and digitalization, are given in Section 4.1.2. We exclude the Romanian industry "Other Services" as it constitutes an outlier. Heteroscedasticity robust standard errors are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A constant is included but not shown. FE = Fixed Effects.

Table 4: Aggregate Effects of Globalization and Digitalization on Ln Employment of the Phillips Curve

Employment (in logs)	(1)	(2)	(3)	(4)	(5)	(6)
Globalization	-0.0262***		-0.0393***	0.0007	0.0007	0.0008
	(0.003)		(0.003)	(0.005)	(0.003)	(0.003)
Digitalization		0.0148***	0.0312***	-0.0001	-0.0001	0.0000
		(0.002)	(0.003)	(0.004)	(0.002)	(0.003)
Country FE	No	No	No	Yes	Yes	Yes
Industry FE	No	No	No	No	Yes	Yes
Decade FE	No	No	No	No	No	Yes
R2	0.11	0.04	0.25	0.73	0.91	0.91
Observations	1096	1096	1096	1096	1096	1096
Countries						

Note: The dependent variable of all regressions in this table is the natural logarithm of employment (Employment (in logs)). The definitions of all variables shown in this table, including for the measures of globalization and digitalization, are given in Section 4.1.2. We exclude the Romanian industry "Other Services" as it constitutes an outlier. Heteroscedasticity robust standard errors are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A constant is included but not shown. FE = Fixed Effects.

Table 5: Transmission Channels of Globalization and Digitalization on the Slope Coefficient of the Phillips Curve

PK Slope	(1)	(2)	(3)
Globalization	-0.0089*	-0.0092	-0.0237**
	(0.005)	(0.021)	(0.010)
Digitalization	0.0108***	0.0189	0.0115**
	(0.004)	(0.015)	(0.006)
Globalization × TFP Growth		0.0083**	
		(0.004)	
Digitalization × TFP Growth		0.0002	
		(0.006)	
Globalization × IT Growth			0.0006
			(0.003)
Digitalization × IT Growth			-0.0090**
			(0.004)
Direct Effects Incl.	-	Yes	Yes
Country FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Decade FE	Yes	Yes	Yes
R2	0.10	0.14	0.14
Observations	1104	520	588
Countries	18	14	12

Note: The dependent variable of all regressions in this table is the slope coefficient of the Phillips curve (PK Slope). It corresponds to coefficient β in Equation (2) and has been estimated in Section 3.3.2. The definitions of all variables shown in this table, including for the measures of globalization and digitalization, are given in Section 4.1.2. We exclude the Romanian industry "Other Services" as it constitutes an outlier. Heteroscedasticity robust standard errors are shown in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. A constant is included but not shown. FE = Fixed Effects.