conseil d'analyse économique

Focus

No 084-2022
April 2022

The Economic Consequences of a Stop of Energy Imports from Russia

David Baqaee, Benjamin Moll, Camille Landais and Philippe Martin(*)

This Focus provides an estimation of the effect of a Russian stop of energy imports. The main results are as follows:

- The impact for France would be modest, with a decline of around 0,15 to 0,3% in gross national income.
- For Germany, the negative impact on gross national income is real (around 0.3% and up to 3% in the most pessimistic scenarios) but overall moderate and can be absorbed.
- The same is true for the EU as a whole, although there is significant heterogeneity in the magnitude of the shock across countries.
- For some EU countries, the consequences are much greater: Lithuania, Bulgaria, Slovakia, Finland or the Czech Republic may experience national income drops of between 1 and 5%.
- These estimates take into account cascading effects along production value chains in a model with 30 sectors and 40 countries. Despite the imprecision of this type of simulation exercise, the orders of magnitude appear very robust: we can rule out with a high degree of confidence a scenario of a GDP collapse of more than 1% for France, for example.
- The relatively low impact of an embargo (except for the aforementioned countries) can be explained by the fact that, even in the short term, companies and the economy as a whole can substitute (even very partially) sources of energy to others and intermediate or final goods to others. The analysis of historical experiences of very strong shocks (Fukushima in Japan or COVID in China) with potential effects along production value chains also shows that individual companies and the economy are able to minimize the impact of the shock. This substitution, even though it is very partial, helps to very significantly mitigate the impact of the shock, compared to a scenario where the entire production and consumption structure is fixed.
- These estimates do not explicitly account for business cycle amplification effects («neo-Keynesian effects») that can further contract aggregate demand and lead to financial difficulties for some firms. But it should be noted that they compensate by relying on very conservative assumptions regarding for instance elasticities of

---

This Focus is published under the responsibility of its authors under their sole responsibility.

(*) UCLA ; London School of Economics; London School of Economics and CAE; CAE chair and Sciences Po.

substitution. Furthermore pessimistic calibrations with "neo-Keynesian" frictions deliver amplification of at most a factor of 2 in the absence of any policy response. In practice, policy responses (such as short-time work policies, bail-out of more exposed industries) can attenuate a significant part of amplification. This points to the importance of the policy mix (monetary and fiscal) that must accompany an embargo.

- An alternative to a total embargo is a very sharp reduction in energy imports from Russia with a 40% tariff on Russian fossil fuel imports. Our preliminary results suggest that such a tariff reduces by about 80% the quantities imported (compared to 100% in the case of an embargo). Above all, the economic losses, especially for the countries most dependent on Russian supplies (Lithuania, Bulgaria...) are greatly reduced compared to an embargo: losses are divided by about 3 or 4. The difference is very small for countries such as France, on the other hand. The reason for the very strong reduction is that the remaining 20% of remaining imports go to the countries and companies that are most dependent on this source of supply of supply.
- We also discuss the potential benefit of a price cap on the European market that would counter the speculative pressure.

Ce *Focus* fournit une estimation de l'effet d'un embargo sur les importations d'énergie par la Russie. Les principaux résultats sont les suivants :

- Pour la France, l'impact serait faible, avec une baisse d'environ 0,15 à 0,3 % du revenu national brut.
- Pour l'Allemagne, l'impact négatif sur le revenu national brut est réel (environ 0,3 % et jusqu'à 3 % dans les scénarios les plus pessimistes) mais globalement modéré et peut être absorbé.
- Il en va de même pour l'ensemble de l'UE, bien qu'il existe une hétérogénéité importante dans l'ampleur du choc entre les pays. Pour certains pays de l'UE, les conséquences sont beaucoup plus importantes : La Lituanie, la Bulgarie, la Slovaquie, la Finlande ou la République tchèque peuvent connaître des baisses de revenu national comprises entre 1 et 5 %.
- Ces estimations tiennent compte des effets de cascade le long des chaînes de valeur de production dans un modèle comportant 30 secteurs et 40 pays. Malgré l'imprécision de ce type d'exercice de simulation, les ordres de grandeur apparaissent très robustes : on peut écarter par exemple avec un haut degré de confiance un scénario d'effondrement du PIB de plus de 1 % pour la France.
- L'impact relativement faible d'un embargo (sauf pour les pays précités) s'explique par le fait que même à court terme, les entreprises et l'économie dans son ensemble peuvent substituer (même très partiellement) des sources d'énergie à d'autres et des biens intermédiaires ou finaux à d'autres. L'analyse des expériences historiques de chocs très forts (Fukushima au Japon ou Covid en Chine) ayant des effets potentiels tout au long des chaînes de valeur de production montre également que les entreprises individuellement et l'économie globalement sont capables de minimiser l'impact du choc. Cette substitution, même très partielle, permet d'atténuer très significativement l'impact du choc, par rapport à un scénario où toute la structure de production et de consommation est figée.
- Ces estimations ne tiennent pas compte explicitement des effets d'amplification du cycle économique (« effets néo-keynésiens ») qui peuvent contracter davantage la demande globale et entraîner des difficultés financières pour certaines entreprises. Mais il faut noter que cela est compensé par le recours à des hypothèses très conservatrices concernant par exemple les élasticités de substitution. En outre, un scénario pessimiste avec des frictions « néo-keynésiennes » conduirait à multiplier

par deux au maximum l'impact négatif en l'absence de toute réponse de politique économique. En pratique, les réponses de politique économique (telles que les politiques de chômage partiel, le renflouement des industries les plus exposées) peuvent atténuer une partie significative de cet effet d'amplification. Cela montre l'importance du dosage des politiques (monétaire et fiscale) qui doit accompagner un embargo.

- Une alternative à un embargo total est une réduction très forte des importations d'énergie en provenance de Russie avec un tarif de 40 % sur les importations de combustibles fossiles russes. Nos résultats préliminaires suggèrent qu'un tel tarif réduirait d'environ 80 % les quantités importées (contre 100 % dans le cas d'un embargo). Dans ce cas, les pertes économiques, notamment pour les pays les plus dépendants des approvisionnements russes (Lituanie, Bulgarie...) seraient fortement réduites par rapport à un embargo : les pertes seraient divisées par environ 3 ou 4. En revanche, la différence est très faible pour des pays comme la France. La raison de cette très forte réduction est que les 20 % d'importations restantes iraient aux pays et aux entreprises les plus dépendants de cette source d'approvisionnement.
- Nous discutons également de l'avantage potentiel d'un plafonnement des prix sur le marché européen qui permettrait de contrer la pression spéculative.

1. Estimating the Economic Consequences for France of a Stop of Russian Energy Imports

1.1.What Would Be the Magnitude of the Shock to Energy Inputs?

To understand the economic effects of a sudden stop of Russian energy imports, it is useful to first get a sense of what this stop would imply in terms of reduction of available energy inputs for the French economy. This requires documenting the structure of our energy consumption and making some assumptions on how the global world supply of fossil fuels would adjust.

Although France is less reliant on fossil fuels than other European countries like Germany, fossil fuels still represent a significant share of its primary usage of energy. Natural gas stands for around 15% of France's primary energy usage, and oil for 29%. While France is less exposed to Russian fossil fuels imports than Germany, Russian gas still represents about 20% of French natural gas consumption (this number is 55% for Germany).

Table 1. Primary energy consumption in France and Germany

	Germany				France			
	Oil	Gas	Coals	Other	Oil	Gas	Coals	Other
TWh	1077	905	606	799	830	433	86	1505
%	31,8	26,7	17,9	23,6	29	15	3	53
from Russia	34%	55%	26%	0%	13%	20%	30%	0%

Note: Numbers for France are for 2019.
Source: Datalab *Chiffres clé de l'énergie 2020*, ministère de la Transition écologique.

How would the world supply of fossil fuels adjust to a complete European ban of energy imports from Russia? The IEA estimates that in the short run, Liquified Natural Gas (LNG) could compensate only between 10 and 15% of Russian imports of natural gas to Europe.

Substituting Russian imports of oil and coal will likely be much easier. Sufficient world market capacity exists from other oil and coal exporting countries to make up for almost the entire shortfall, although maybe not 100% of the shortfall.

Second, most experts agree that the share of natural gas used in the production of electricity can be quickly substituted away by using alternative sources of electricity generation. We are thus left with a situation where the remaining consumers of energy (households, industry, services) will have to cope with the residual reduction in aggregate natural gas supply. Of that residual consumption of natural gas, around a third relates to industry consumption, while households and services account for the remaining two thirds.

Table 2. Residual Gas consumption (net of electricity generation) across sectors

	Germany	France
Industry	36%	37.5%
Households	31%	50%
Services, trade & commerce	28%	12.5%

Note: Numbers for France are for 2019.
Source: Datalab *Chiffres clé de l'énergie 2020*, ministère de la Transition écologique.

In light of this, a realistic prediction is that an import ban would create a shortfall of about 15% of natural gas available to the French economy and a total shortfall of energy inputs of about 3%, to be picked up by households, industry, and services. For comparison, the corresponding numbers for Germany are 30% and 8%.

This 15% shortfall in natural gas (and 3% reduction in energy inputs) constitute our « baseline » scenario for France. We also investigate the effects of a very conservative scenario where substitution possibilities are much more limited and France has to compensate some of its European partners for their own shortfall in gas imports. In this conservative scenario, the shortfall of natural gas available is 25%, equivalent to a 5% reduction in available energy inputs.

1.2. Building Intuition for Credible Magnitudes of the Economic Effects

How would the French economy respond to such a 3% shock to its energy inputs, our baseline scenario?

Before delving into the results from simulations of a state-of-the-art model, it is useful to build intuition for the range of effects that can be expected. For this, one needs to understand that the magnitude of the shock on national income will depend on three fundamental things:

- The magnitude of the input shock, that is, by how much energy imports used in the economy are reduced by the ban. Like we said in the previous subsection, we assume for our baseline scenario that this shock is -3% of energy inputs, and -15% for natural gas supplies (and -25% in natural gas supplies in our most conservative scenario);
- The share of that input in the economy's national income: the higher this share the more important (« productive ») is the input, and as a consequence, the more costly it is to reduce its usage;
- The elasticity of substitution between this input and all the other inputs participating in the production of national income: the higher this elasticity, the easier it is to adjust the

production process and « replace » the reduction in energy input by the usage of other inputs.

In France, the share of energy inputs in national income is a bit lower than 4%. And the share of fossil fuels imports in national income is just 2%. The share is only 0.7% for natural gas. For comparison, the share of fossil fuels imports in national income is 2.5% for Germany, and their share for natural gas imports is 1.2%.

These import shares are small, and *prima facie*, this suggests that the overall shock to the economy should be small, as these inputs represent a small part of national income. But this line of reasoning misses an important dimension, which is that energy is a critical input in production, which can be hard to substitute away, creating some potentially very large amplification effects, whose magnitude depends on the elasticity of substitution.

This « aggregate » elasticity of substitution between energy inputs and all other inputs is not easy to pin down: it depends on the input-output linkages between sectors (supply chain), on the available technology, on the mobility of factors such as labor and capital across sectors, on the way final consumers will substitute consumption across goods who differ in their energy intensity, etc.

One can already get an estimate of the absolute worst case scenario, a very conservative upper bound on the overall magnitude of the effect on national income, by considering an economy where this elasticity of substitution is zero. This is an economy whose entire process of production is fixed and cannot be adjusted: this is the worst possible case of models of cascade where shocks propagate down the supply chain. Imagine for instance an economy that produces one final good, bottles, that can only be assembled by one specific machine, which can only be delivered by a specific truck, that can only be constructed with four wheels. And wheels are imported from abroad. In this economy with no substitution, a shock to a specific input fully propagates through the supply chain, even if the input represents only a tiny fraction of the overall value of the entire supply chain: if the imports of wheels from abroad decline by 10%, the production of trucks will decline by 10%, leading to 10% fewer machines being delivered, leading to 10% less bottles being produced.

If we apply this logic to the expected shock of a ban on Russian energy inputs, this means that, in the total absence of substitution, a 3% reduction in energy inputs would lead to a 3% decline in national income. Similarly, if we focus on gas as a separate input in this fixed economy without any substitution, a 15% decline in gas inputs leads to a 15% decline in national income. But this assumption of zero elasticity of substitution is totally unrealistic. It is not supported by any historical evidence, nor by any existing empirical research. From the impact of the sudden shutdown of nuclear power plants in Japan following Fukushima (Neidell, Uchida, and Veronesi 2019), to the sudden disruptions of Chinese supply chains in the aftermath of the covid crisis (Lafrogne-Joussier, Martin & Mejean 2022), evidence shows that substitution, while being far from perfect (shocks do propagate) is also clearly different from zero. For instance, Lafrogne-Joussier, Martin and Méjean compare the reaction of two types of French firms to a containment shock in China (2020): those that depend on Chinese inputs and the others. Admittedly, the former are more affected more than the latter in terms of production, but after 2 to 3 months the difference disappears. Moreover, among the firms that depended on Chinese inputs, those that had only Chinese suppliers were not more affected than those that also had alternative suppliers in other countries. This suggests that French firms were able to quickly find alternatives.(1)

(1) For more details and other historical examples showing the presence of significant substitution following large input shocks, see Appendix B to Bachmann *et al*. (2022) at https://benjaminmoll.com/RussianGas_Substitution/

Indeed, there are many sources of adjustment in the economic system:

- Substitution between inputs and factors of production in the production function of each firm: for almost all firms, their production "recipe" is never completely fixed; they can change the "mix" of ingredients in their "recipe". When this is complicated at the firm level, this kind of substitution arises at the sector level through the arrival of new entrants, new firms whose "recipe" production is slightly different;
- Substitution between intermediate goods;
- Substitution between final consumption goods: if there is a shortage of energy inputs, consumers may substitute away from final goods whose production is intensive in energy inputs.

This means that the economy never behaves at the macro level as in a purely "Leontief" world. This is important because a world where substitution is impossible, and a world where even a small amount of substitution is possible, behave drastically different at the macro level, as shown in our simple simulations (see *infra*).

The meta-analysis by Labandeira *et al*. (2017) provides a summary of the existing estimates on substitution elasticities for energy consumption differentiated between the short run (less than one year) and the long run (after one year). The relevant short-run average short-run elasticity for energy is – 0.22, for natural gas it is – 0.18, and the least elastic in the short run is heating oil with – 0.02. Differences between residential and industrial consumers are small.

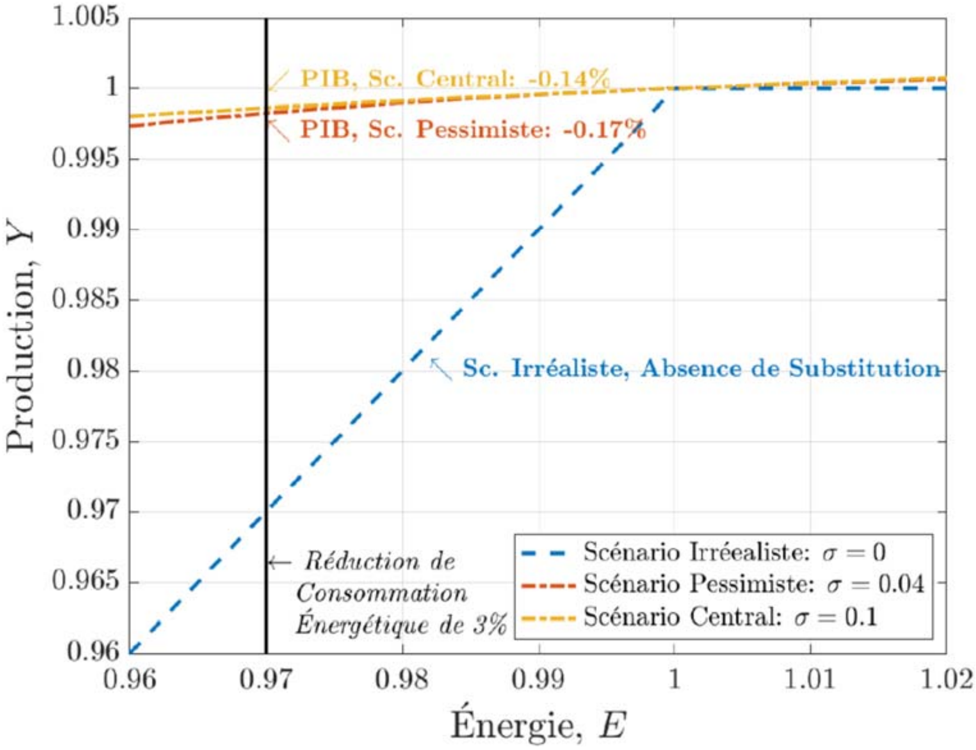
It is implausible, therefore, to assume that even in the short-run the elasticity of substitution is zero. Producers and households will switch to other inputs to some extent, change their consumption baskets, or outrightly import energy, especially gas, or products with high energy content that can be transported in bulk. This qualification is important as the difference between a very small, but non-zero, and a literally zero elasticity translates into drastically smaller economic losses than in the case of zero substitutability as depicted in Figure 1. The figure shows how economic losses evolve as a function of the size of the change in energy input for three different scenario regarding the elasticity of substitution s. In our baseline scenario, energy inputs *E* are down from 1 to 0.97, a 3% drop. The blue line depicts the unrealistic scenario of total absence of substitution s = 0. The dashed red line depicts a very pessimistic scenario of very low elasticity s = 0.04. And the dashed yellow line represents a credible scenario for the short run of low elasticity s = 0.1.(2) Even in the pessimistic scenario of very low elasticity, the economic loss amounts to just – 0.17% in national income, which is 17 times smaller than in the zero elasticity benchmark.(3)

(2) In order to be as conservative as possible in our estimates, and to take into account that in the very short term the substitution mechanisms may be limited, we use elasticities of substitution between 2 to 5 times smaller than the average reference elasticities of Labandeira *et al*. for the short run.

(3) For more details on these approximations, see Appendix to Bachmann *et al.* (2022), available at:

https://benjaminmoll.com/wp-content/uploads/2022/03/RussianGas_Appendix.pdf

Figure 1. Output losses following a fall in energy supply for different elasticities of substitution



Notes: The figure shows how economic losses evolve as a function of the size of the change in energy input for three different scenario regarding the elasticity of substitution s. The blue line depicts the unrealistic scenario of total absence of substitution s = 0. The dashed red line depicts a very pessimistic scenario of very low elasticity s = 0.04. And the dashed yellow line represents a credible scenario for the short run of low elasticity s = 0.1. In our baseline scenario, energy inputs *E* are down from 1 to 0.97, a 3% drop. The size of the economic loss is therefore given at the intersection between the vertical black line and the relevant curve.

Overall, this simple approach suggests that even for very modest elasticities of substitution, the economic losses of a Russian ban are small, and largely manageable for France. In a scenario of a low elasticity s = 0.1 (i.e. a low elasticity compared to existing estimates in the literature), a 3% reduction in energy inputs would cause a -0.14% decrease in national income, equivalent to a €70 decrease per capita in annual income in France. In the more specific scenario of a reduction in natural gas supplies (rather than energy inputs more broadly), we get the following effects on national income:

A. Decrease in available gas (reference scenario) = – 15%.
Elasticity of substitution in the short term: 0.1
Decrease in national income for France: – 0.15%
Elasticity of substitution in the short term: 0.04
Decrease in national income for France: – 0.25%.

B. Drop in available gas (hard scenario) = – 25%.
Elasticity of substitution in the short term: 0.1
Drop in national income for France: – 0.31%
Elasticity of substitution in the short term: 0.04
Decrease in national income for France: – 0.59%

These numbers are again relatively small. In the conservative scenario of a 15% decline in gas supplies with a very low short run elasticity of substitution of 0.04, the cost per capita would amount to about €100 in France. Note that this is considerably smaller than the cost per capita in Germany, which could be up to €800-900 using similar calculations, as the shock to their gas supplies would be larger.

Note that we assume here that gas reduction falls evenly or "efficiently" across sectors, that is, we assume that the economic actors that reduce their gas consumption the most are the ones for whom the value of this gas consumption is the smallest. But, if certain policy decisions were to be made to protect certain sectors from the shortfall in an inefficient way, the overall economic impact could be larger due to the misallocation of the remaining gas supplies.

One should also mention that these calculations account for the short run effects, where substitution is likely difficult. But robust evidence suggests that substitution increases over time (e.g. Caballero, 1994): the long run effect of the ban could therefore be even significantly saler.(4)

1.3. Simulation Results from State-of-the-Art Multi-Sector Multi-Country Model

As mentioned above, the extent of substitution in response to a ban on energy inputs will depend on the full input-output structure of the economy. In other words, the way the shock will propagate depends on how different sectors use as inputs the production of other sectors. To validate our simple estimates of the economic losses of a Russian ban on imports, we therefore use a state-of-the-art multi-sector multi-country model (Baqaee & Farhi, 2021) that fully accounts for the input-output interlinkage structure of 30 sectors across 40 countries. In this model, we simulate the effect of a total import ban from all Russian imports on the economy of all European Union countries.

The rich input-output structure of the model allows for proper foundations of the cascade effects along the economic production network that would be realistically created by a shortfall of Russian energy imports. In that sense, the model is a more realistic model of the likely effects of a shortfall than the simple calibration from the previous subsection.

But the other key additional feature of the Baqaee & Farhi model is that, as opposed to the simple calibrations above, it allows for trade, and therefore adds a key additional source of potential substitution via imports. In other words, if the chemical industry cannot produce fertilizers locally because of a shortage in gas supplies, it is very likely that local agricultural producers are going to start buying more fertilizer abroad. The possibility of substitution using imports also alleviates the risk of extreme cascade effects.
The results from this model corroborate the magnitude of the simple estimates, and confirm that a ban on Russian imports would have a limited effect on the French economy. It would decrease French national income by about 0.15 to 0.2%, that is a loss of €91 *per capita*.

One interesting point is that while the effects would be larger for Germany (around .3% loss, equivalent to €100 per capita), the difference would be much less pronounced than in the

(4) Indeed, substitution mechanisms may take time to be set up. In practice, the elasticities of substitution estimated in the literature appear systematically and significantly stronger in the long term than in the short term. Two very important points to keep in mind on this issue of increasing substitution possibilities over time:

- The short-term elasticity of substitution may be very seasonal: it is probably much more difficult to cope with a sudden drop in available natural gas in the middle of winter than during the summer. It is therefore crucial to optimize the timing of sanctions to avoid a sudden and unanticipated shock to gas supply in the middle of winter.
- The use of a strong form of forward guidance should encourage substitution behavior. If we make it clear to firms and households that the available quantities of gas will be limited in the next six months to nine months, they can already start to adjust before the supply shock occurs. From this point of view, the use of a tariff on Russian energy imports over the next 3 to 9 months, rather than an embargo or a quota, greatly reduces economic losses: it allows for advance notice of the expected evolution of Russian oil and gas prices, and to optimize the timing of substitutions within the economic network.

calibrations from the simple model. This is in large part due to the fact that trade largely diffuses the magnitude of the shock across countries: if Germany is badly hit by a decrease in its gas supplies, this will also affect negatively its trading partners like France, while Germany will also be able to use to cushion the shock by substituting intermediate goods with imports from France. So the shock for Germany will be more diffused across countries than in the case where no trade is possible.

Table 3. Estimates of the economic costs of a complete shortage of Russian energy imports

	Baqaee-Farhi (2021)	Simple Model *Energy Decline*	Simple Model *Gas Decline*
A. Germany			
Input Decline		*10%*	*30%*
GDP Loss (%)	0.3	1.3	2.2
Per Capita (ca., p.a.)	€100	€600	€900
B. France			
Input Decline		*3%*	*15%*
GDP Loss (%)	≈ 0.2	0.2	0.3
Per Capita (ca., p.a.)	€91	€70	€105

Admittedly, one of the limitations of simulations using the Baqaee-Farhi model is that they feature an aggregated "Electricity, Gas and Water Supply" sector rather than a separate "Gas" sector, i.e. gas is not a separate input in production. Two important points may however help to appreciate the sensitivity of our results to this limitation:

- To compensate for the impossibility of disaggregating gas inputs, we use much lower elasticities of substitution in the Baqaee-Farhi model simulation than those usually used in the literature, which are themselves based on numerous empirical studies. Intuitively we compensate for the fact that oil and gas appear implicitly as substitutes in the model by making all energy inputs (gas, oil, coal) much less substitutable with the rest of the economy's inputs than they are according to estimates in the relevant empirical literature.
- The credibility of the orders of magnitude can be checked using a second-order approximation that is valid for a very large class of models, regardless of the structure of the production system and can thus be applied to calculate economic losses in the case in which gas is a separate input. It tells us that the effect of a particular input depends on three statistics: the share of that input in national income, the elasticity of substitution between that input and all other available and the size of the reduction in the supply of that input. Applying this approximation to a specific reduction in the supply of the available gas supply (and thus taking into account the specificities of gas compared to other compared to other fossil fuels), it seems credible to us to conclude that even in a very conservative scenario in terms of the size of the energy shock and substitutability in the short term, we can exclude that the causal effect on French national income of an embargo on Russian energy imports is much higher than 1%.

We should also emphasize that the current simulations assume away business cycle amplification effects ("neo-Keynesian effects") that can arise due to the presence of various frictions such as wage and price stickiness as well as financial amplification effects. For instance wage rigidity may create excess layoffs, and inefficient unemployment in the most affected sectors, further contracting aggregate demand, and amplifying the initial shock. Similarly, certain firms may face financial difficulties or even default, so that the shock could propagate through the financial sectors in the presence of financial frictions.

But one should note that first, we compensate for the lack of such frictions with very pessimistic calibration throughout: we halve elasticities compared to the literature, we round up headline numbers for the economic costs, we focus on a simple model where substitution with imports is absent, etc. Second, we also should stress that, the Baqaee-Farhi model is not without frictions: for instance, it has significant adjustment costs by preventing capital and labor reallocation across sectors. We also ran pessimistic sticky price calibrations in the Baqaee-Farhi model which deliver amplification of at most a factor of 2 in the absence of any policy response. In practice, policy responses (such as short-time work policies, bail-out of more exposed industries, see more on this in section 3 below) can attenuate a significant part of amplification. This point is further corroborated by the recent work of Bayer, Kriwoluzky, Seyrich & Müller (DIW, 2022) who also find limited amplification effects of a similar energy import shock. But this of c ourse requires putting in place the right policy mix, which requires in this case that targeted fiscal support to the exposed firms and households be combined with a tightening of monetary policy, and an increase in interest rate.

2. Estimates of the Economic Effects of a Russian Ban for All EU27 Countries

The Baqaee-Farhi model allows to compute estimates of the effect of a Russian ban on imports for all EU countries (with the exception of Croatia).(5) The differences in the impact stem from differences in the exposure to Russian imports, which differs considerably across EU countries, as well as from differences in the economic structure of EU countries which determine how the shock propagates along the input-output linkages throughout the economy. Results show first that there is considerable heterogeneity in the impact of the Russian ban across European countries. A handful of countries (e.g. Lithuania, Bulgaria, Slovakia, Finland, Czech Republic) would be very severely affected. To the contrary, France would be one of the least affected country in Europe, along with Spain and Portugal, and even Italy. Germany, while more exposed than France, would face a manageable shock of around 0.3% of national income (Bachmann et al. 2022). As a result, the average effect on the EU27 economy would be manageable on average: it would represent a decline of 0.2 to 0.3% of income, or about €100 per European adult.

In light of this very heterogeneous impact of economic losses across European countries, imposing a hefty European-wide tariff may prove more efficient than a straight ban. It could allow the small but most exposed countries such as Lithuania or Slovakia, to continue to access some Russian gas imports, while drying up imports to larger and less exposed countries that are more able to substitute away from Russian imports. Maintaining even a very limited amount of imports can lead to large efficiency gains because of their large value to the countries and firms most dependent on Russian energy imports.

To implement in practice a scenario where a limited amount of Russian gas imports are allowed, a high tariff is preferable to a quota because the “rent”, i.e. the associated tariff revenues (even if small given that the objective is to strongly reduce quantities) would accrue to the EU. In the case of a quota, the price increase (even on a limited amount of imports) is transferred as a rent to Russia. A price cap on wholesale prices is also possible but this would transfer the rent to European wholesalers who would be able to sell at higher prices (given the excess demand at the price cap) to retailers. Hence, we believe that a tariff is a better option.

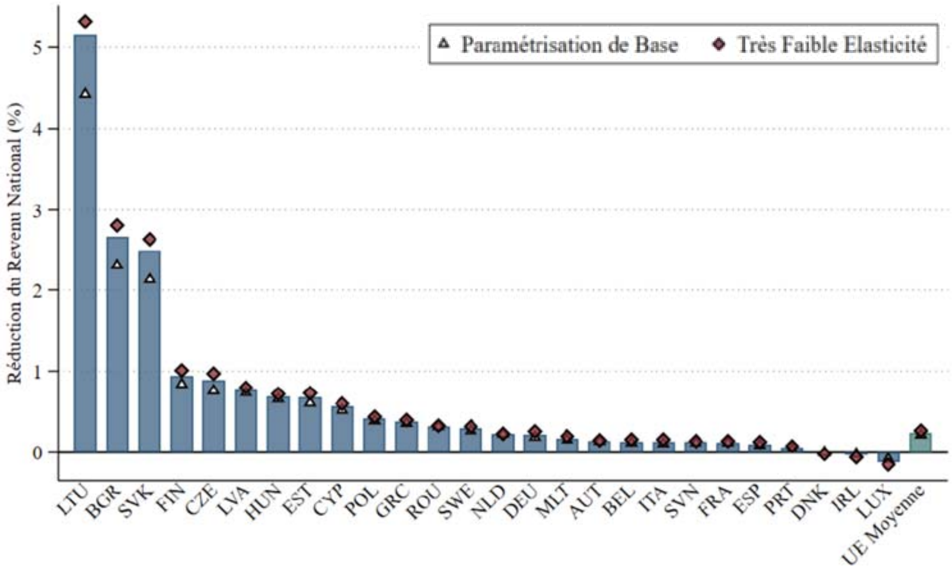
(5) Similar calculations using the version of the Baqaee-Farhi model used in Bachmann et al (2022) have been conducted by Langot and Trippier (2022).

Given the range of estimated tariff elasticities on oil and gas imports (Hertel et al. 2007) and the fact that the relevant timeframe is very short term we retain a tariff around 40% if the objective is to reduce Russian gas and oil imports by around 80%. Given the uncertainty on these estimates, one may leave open the possibility of further increases in the tariff. Our preliminary results show that a 40% tariff reduces the economic losses, especially for the countries most dependent on Russian supplies (Lithuania, Bulgaria...) compared to an embargo: losses are divided by about 3 or 4. The difference is very small for countries such as France, on the other hand. The reason for the very strong reduction is that the remaining 20% of remaining imports go to the countries and companies that are most dependent on this source of supply of supply.

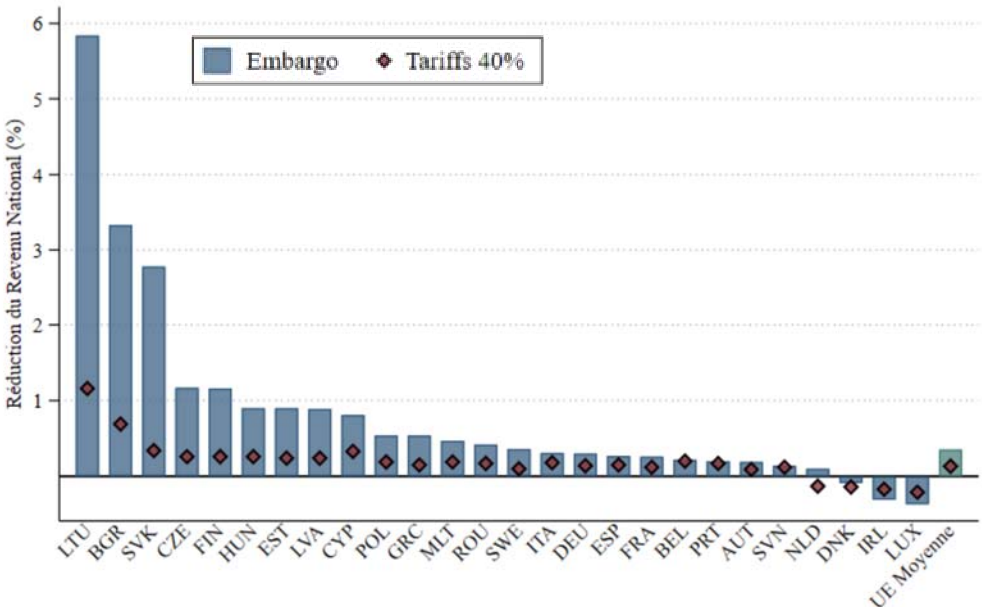
Some European solidarity will nevertheless be necessary to convince the most exposed countries to participate in such economic sanctions.

Figure 2. Estimated output losses from a stop of Russian energy imports for EU country (excl. Croatia): Simulations from Baqaee-Farhi (2021) model

a. Impact of a complete ban on Russian energy imports for different calibrations



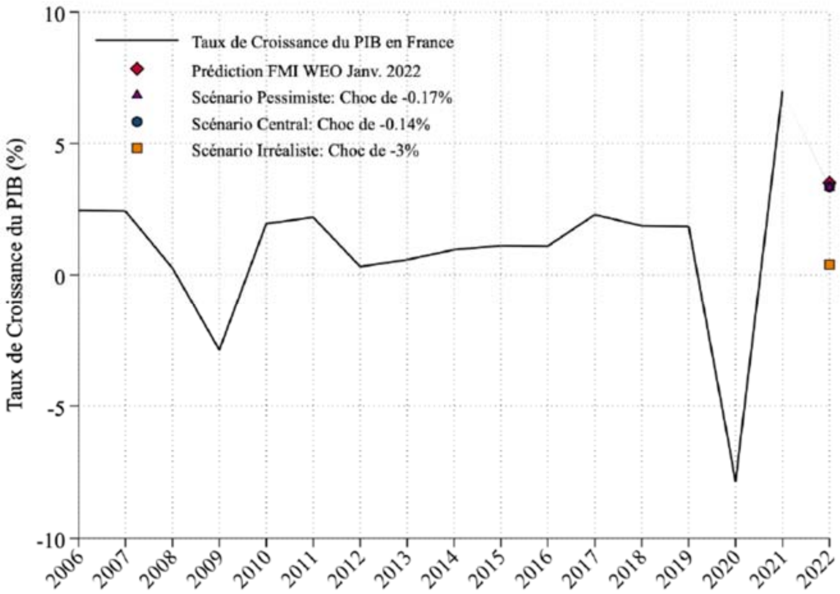
b. Impact of a complete ban vs a 40% tariff on Russian energy imports the most pessimistic calibration in terms of substitution



3. Policy Measures for Dealing with the Economic Consequences

The economic consequences of a stop of Russian imports appear to be manageable for most European countries including France. To put things in perspective, even in a totally unrealistic scenario of a 3% decline in French output, this would not drive France into recession for 2022. For countries like Germany, the size of the shock might be larger, but still smaller than the COVID shock for instance. And we note as well that it is important that a sound macro policy mix is put in place to avoid further amplification of the shock, with a tightening of monetary policy while preventing amplification effects on aggregate demand by targeted fiscal policies on most affected sectors and households.

Figure 3. Putting Estimates of Output Losses in Perspective



Notes: The figure shows the evolution of GDP growth in France and for 2022 the predicted GDP growth from the latest IMF forecast (red diamond). We also show what GDP growth would be in the case of a Russian import ban causing a 3% decline in energy inputs depending on the assumption made on the elasticity of substitution. We see that in the baseline scenario (s = 0.1) and pessimistic scenario (s = 0.04) the economic loss is extremely small relative to the usual fluctuation in GDP. Only a clearly unrealistic scenario of zero substitution would create a sizeable, although manageable, shock to the French economy.

Indeed, as in all recessions, these moderate aggregate effects would be unequally distributed across sectors, firms and individuals. And some policy measures will be needed to accompany the heterogeneous effects of the shock across countries, across sectors, and across individuals.

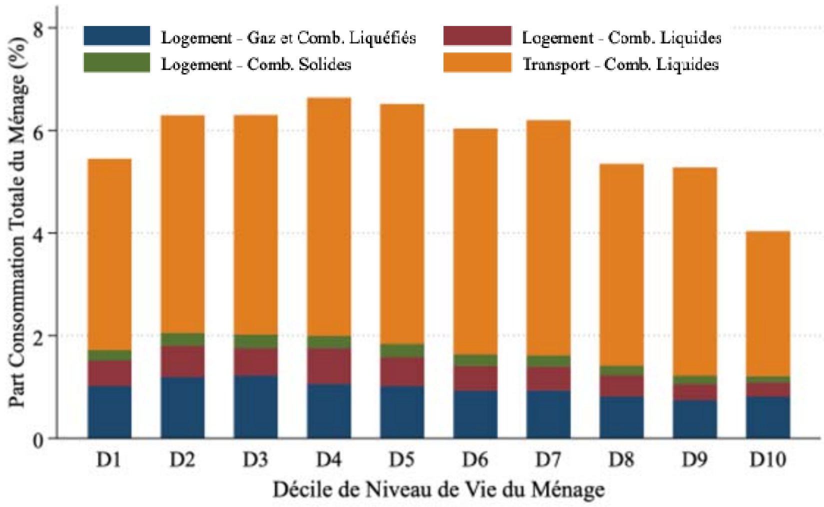
Four important sets of fiscal policy measures are likely to be needed:

- Labor market policies to cushion the shock to specific sectors and workers: the ban will disrupt the activity of certain sectors who rely more heavily on energy inputs (e.g. chemical industry, etc.). The severity and persistence of the shock is uncertain, and will depend on the duration of the sanctions and the ability of these sectors to substitute towards other inputs. This is a textbook case for using targeted short-time-work (chômage partiel) policies for specific sectors.
- Redistributive policies to alleviate the shock for most affected households. The proper targeting of these compensation policies requires a bit of creativity. The reason is that income alone might be an imperfect proxy for measuring the incidence of the economic shock. As shown in Figure 3 below, the share of total expenditure spent by households on natural gas or fossil fuel for heating is small (around 1 to 2%), but is quite similar

across income groups. Furthermore, there is considerable variance within each income group in these expenditure shares: for certain households (e.g. living in rural areas) these expenditure shares might be considerably larger. If compensations are exactly proportional to actual gas usage, they prevent the price signals to do their work and fully alleviate the incentive effects to substitute away from gas. But if they are not at all proportional to gas usage, they may create extreme political resentment from the small fraction of households that is the most exposed.

Such issues are thorny, but will take center stage in the debate, as, based on our calculation, a shortfall of energy imports from Russia would likely double the price of natural gas in France. As the share of natural gas in total consumption is small, this explains why the average cost is small (around €100 in France), and could be easily compensated. But a doubling of natural gas prices could be very damaging to the most exposed households. A potential solution would be, first to use proxies (e.g. such as rural vs urban) to target income compensation and second to mix income compensation for a large fraction of the population with income-based price subsidies at the bottom of the income distribution to very strongly cushion the shock for those who are the most exposed to gas price increases among these households.

Figure 4. Fossil fuel expenditures of French households by income level



Sources: INSEE enquête budget des familles 2017. Notes: The figure reports the share of expenditures on fossil fuels for heating and transportation in total expenditures in France, broken down by decile of disposable income per consumption unit.

– Measures to boost the overall pace of substitution away from fossil fuel imports.

The substitution elasticity can grow significantly over time, reducing the economic cost of a reduction in Russian imports. But for this, firms and households must be given the right signal and the right incentives. Income transfers for households are therefore preferable than price controls than may critically delay the pace of adjustments to cleaner technologies.

– Potential targeted bail-outs or partial nationalizations, for the most affected industries (e.g. BASF in Germany) to prevent contagion to the financial sector.

On these policy fronts, European solidarity could also be deployed to alleviate the consequences for the most exposed countries, by using the SURE European fund for short-time-work policies, or by the creation of dedicated European compensation fund for the most affected sectors and countries.

4. Anticipation of shortfalls, speculation and the role of price caps

We finally note that spot prices for natural gas are extremely high and volatile since December 2021 and even more so since the beginning of the war in Ukraine due to potential speculative pressures (i.e. the speculative anticipation of future price increases). As noted by Peter Zeniewski (Energy analyst for the IEA World Energy Outlook) gas prices on spot markets are "at levels difficult to justify based on the fundamentals". This increase in price benefits Russia significantly, even in the absence of any shortfall from Russia, just due to the anticipation of a potential future ban or of future reduction in gas supplies. So any speculative increase in the price benefits Russia immediately.

A very natural first step would therefore be to impose a price cap in prices on the European market to prevent Russia to benefit from such speculation. It would reduce part of the speculative demand by eliminating the upside on future prices. As a result, the spot price may actually decrease even if the EU decides a cap at today's price. Such a cap would be doable because at today's price €123 per megawatt-hour, other exporters like Norway and Algeria would still be significantly higher than their marginal cost of production (cost of production is around €10 per megawatt-hour for Norway and €5 for Russia).

While a price cap at today's price does not really address the medium run issue, it does not rule out further measures: a specific Russian tariff on top of the price cap could still be applied for instance.

References

Bachmann R., D. Baqaee, C. Bayer, M. Kuhn, B. Moll, A. Peichl, K. Pittel and M. Schularick (2022): "What if? The Economic Effects for Germany of a Stop of Energy Imports from Russia", *ECONtribute Policy Brief*, no 28/2022.

Baqaee D. and E. Farhi (2021): "Networks, Barriers, and Trade", *Working Paper*.

Bayer C., A. Kriwoluzky and F. Seyrich (2022): "Stopp Russischer Energieeinfuhren würde Deutsche Wirtschaft spürbar Treffen, Fiskalpolitik Wäre in der Verantwortung", *DIW Actuel*, no 80, DIW Berlin, German Institute for Economic Research.

Hertel T. Hertel, D. Hummels, Maros Ivanic, Roman Keeney (2007): "How Confident Can We Be of CGE-Based Assessments of Free Trade Agreements?", *Economic Modelling*, no 4, pp. 611-635.

Labandeira X., J.M. Labeaga, and X. Lopez-Otero (2017): "A Meta-Analysis on the Price Elasticity of Energy Demand", *Energy Policy*, no 102, pp. 549-568.

Langot F. and F. Trippier (2022) : " Le coût d'un embargo sur les énergies russes pour les économies européennes », CEPREMAP, no 2022.